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ABSTRACT

This report addresses a central issue in postsecondary education: how much space is likely to be needed to accommodate the enrollments between 1975 and 1990 in both the nonprofit and proprietary educational sectors. Emphasis is placed on projections of postsecondary enrollments, size distribution of institutions and campuses, current perception of space requirement needs, comparison of space-to space standards, statistical determination of space standards, an estimate of stocks 1970-1990, proprietary postsecondary schools, cost of construction, new technologies and attendance patterns, and how much space is really needed. Statistical data are presented within the report as well as within the attached appendixes. (MJM)

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THE DEMAND FOR FACILITIES IN THE POST-SECONDARY SECTOR, 1975 TO 1990

Contract OEC-O-72-5023

by

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With the Assistance of

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August 15, 1974

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The views expressed in this study are those of the authors, and do not necessarily correspond to those of the Department of Health, Education and Welfare, U. S. Office of Education.

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SUMMARY AND CONCLUSIONS

This study of the facilities needs of the post-secondary schools was conducted at an interesting time. The long period of increasing undergraduate degree-credit enrollments had come to an abrupt end. Graduate and professional enrollments were still growing apace, but it was not at all clear how long this could continue. The only segment of post-secondary education which exhibited sustained growth, and is currently the fastest-growing of all, is the vocationally oriented one catering to non-degree-credit students.

There is a growing consensus that enrollments will not grow as fast in the post-secondary sector as had been projected in the past. Hence, a revised set of projections was developed for this study. Table A presents a comparison of these estimates with some previous efforts to forecast the workload of the post-secondary sector. If the low, and pessimistic, projection describes future enrollments, it is quite likely that degree-credit students may fall short of most forecasts by as much as 1.0 to 1.5 million.

In our field visits, we found that this message apparently had not reached campus planners. Extensive construction plans for many public institutions are still being justified on the basis of fairly high enrollment targets prepared a number of years ago. In the few

TABLE A

ENROLLMENT PROJECTIONS FOR 1975 AND 1980 BY VARIOUS ORGANIZATIONS

(Thousands of FTE Students)

	1975		1980	
	Degree-Credit Only	All	Degree-Credit Only	All
NCES (1968)	7,283	7,283	n.a.	n.a.
NCES (1972)	7,472	8,166	8,567	9,431
Norris Committee	8,003	n.a.	n.a.	n.a.
Carnegie Commission	8,052	8,801	9,293	10,156
This Study: High	7,625	8,334	8,343	9,118
" " Low	6,509	7,114	6,969	7,616

Source: Department of Health, Education, and Welfare, Office of Education, National Center for Educational Statistics, Projections of Educational Statistics to 1977-78, 1968 edition, Table 16, p. 24; ibid, 1972 edition, Table 12, p. 33; DHEW, Office of Education, Chalmers G. Norris, Study Group Chairman, Federal Support for Higher Education Construction: Current Programs and Future Needs, Report of the Higher Education Construction Programs Study Group, Table F-10, p. 145; Gus W. Haggstrom, "The Growth of Higher Education in the United States," Project on Statistics of Higher Education of the Carnegie Commission on Higher Education, (mimeographed), Table 1, p. 3.

instances where central planning authorities were trying to delay or reduce the level of construction, their attempts were frustrated by a tug-of-war with individual campus administrators, who, relying on their political connections, were pushing ahead campus construction plans based on overly optimistic enrollment projections.

The private sector has not yet perceived the possibility that the publicly subsidized schools will have more spaces than their traditional "market share." Private school administrators have not faced up to the likelihood that enrollments will decline in private four-year schools as they have in private two-year schools in the recent past.

In summary, it is quite likely that the next few years will be times to try campus planners' souls. In this study, we present a new set of planning factors and techniques to assist them in meeting this new challenge.

At the very outset of the study, we projected new, likely distributions of students between the private and public sectors. The major assumption underlying these projections is that public schools will fill their quotas irrespective of the level of enrollments. Thus, the bulk of the shortfall of enrollments will be borne by the private sector. A comparison of student workloads in the public and private sectors with the latest NCES projections is shown in Table B. Our

TABLE B

PUBLIC AND PRIVATE SECTOR ENROLLMENTS

(Thousands of FTE Students)

		1975		1980		1985		1990	
		Public	Private	Public	Private	Public	Private	Public	Private
NCES		6,332	1,834	7,584	1,847	n.a.	n.a.	n.a.	n.a.
This Study:	High	6,513	1.821	7,420	1,698	7,576	1.657	7,495	1,548
" "	Low	5,560	1,554	6,200	1,416	6,106	1,332	5,730	1,182

n.a.: Not available.

Source: Tables 2.4 and 2.5.

high projection differs only marginally from that of NCES. However, if the low enrollment estimates prove to be accurate, the private sector enrollments will be twenty to twenty-five per cent below forecasts based on past trends.

We expect that, even under pessimistic enrollment projections, enrollments in the public sector will grow, at least between now and 1980. Hence, a number of new institutions are likely to be established, and some present campuses will be expanded to accommodate these students. A projection of campuses by size appears in Table C.

In order to determine the future space requirements, we derived a series of space standards, six in all, one for each of the three types of schools in both the public and private sector--universities, four-year schools, and two-year schools. These standards, which include no provision for technical programs, are shown in Table D. They are most useful for calculating incremental space requirements. In addition, Table D shows somewhat higher space standards which could be used if additional space allowances for small schools and technical programs were included. Finally, these standards are compared to those developed by the Higher Education Construction Program Study Group in the late 1960's.

Under any conceivable standards, the overall shortages of assignable space did not exist by Fall 1971 in either the public or

TABLE C

TOTAL NUMBER OF CAMPUSES IN THE PUBLIC AND PRIVATE SECTORS, ACTUAL 1970, PROJECTED FOR 1975, 1980, 1985, AND 1990

	1970	1975		1980		1985		1990	
Enrollment	1970	Low	High	Low	High	Low	High	Low	High
Public Sector									
More than 20,000	22	25	50	45	68	43	58	38	58
10,000 to 20,000	78	90	70	80	127	77	137	84	132
5,000 to 10,000	211	255	270	275	270	275	285	265	270
2,500 to 5,000	207	225	335	265	345	245	310	225	325
Less than 2,500	787	795	725	735	695	760	635	773	635
Total	1,305	1,390	1,450	1,400	1,505	1,400	1,425	1,385	1,420
Private Sector									
More than 20,000	3	3	3	--	3	--	3	--	3
10,000 to 20,000	10	10	12	13	10	10	10	8	10
5,000 to 10,000	156	156	154	156	156	157	156	157	156
2,500 to 5,000	46	42	46	36	45	34	44	30	39
Less than 2,500	1,286	919	1,168	847	1,058	783	1,012	668	952
Total	1,501	1,130	1,383	1,052	1,272	984	1,225	863	1,160

Source: Table 3.3.

TABLE D

SUMMARY OF ALTERNATIVE SPACE STANDARDS

(Assignable Square Feet per FTE Student)

	(1) This Study's Standards	(2) (1) plus Technical Programs	(3) (2) plus Size Allowance	"Norris Standards"
Public Institutions				
Universities	89.8	97.0	97.0	132.0
Other Four-Year Schools	71.7	75.3	79.8	93.0
Two-Year Schools	51.7	57.9	72.4	70.0
	72.0	77.7	83.8	100.8
Private Institutions				
Universities	117.9	127.3	127.3	150.0
Other Four-Year Schools	119.8	125.8	133.3	103.0
Two-Year Schools	118.4	132.6	132.6	75.0
	119.0	126.8	131.0	116.0

Note: (1) Norris standards include a provision for non-class laboratories, approximately 17.2 and 21.6 sq. ft. per FTE student in public and private universities, respectively, and 2.3 and 7.2 sq. ft. per FTE student in public and private other four-year schools, respectively. Non-class labs occupied 7.2 sq. ft. per FTE student in the public sector and 8.9 sq. ft. per FTE student in the private sector.

(2) Schools in each category are not strictly comparable (see Table 2.3).

Source: Tables 4.7, 11.7, and Norris, loc. cit., p. 7.

private sectors (see Table E). Table E does not show that the averages were masking severe shortages in certain types of space: class laboratories, which were preventing some schools from offering well-rounded programs; study space, which resulted in less than adequate library collections and facilities; and office space, which forced many faculty members to use substandard facilities. This study documents in great detail the inequality of facilities between schools, and, if widely disseminated, should draw the attention of planners to this topic.

Unfortunately, no precise statistical explanation of required space, or current practices about space usage, could be derived from an elaborate set of statistical regression analyses. These analyses contributed to an understanding of some of the factors which affect space demands: (1) the number of FTE students, (2) the number of FTE staff, (3) expenditure patterns, and (4) in the case of schools offering doctorate programs, their course mix. In the case of private universities, nearly one-fifth of the available space was explained in regression equations by heavier-than-average doctorates in natural, physical, and biological sciences.

In order to forecast availability of space, future retirement rates must be considered. Since over 40 per cent of the non-residential space in the public sector and 30 per cent in the private sector has been

TABLE E

AVAILABLE NON-RESIDENTIAL SPACE, FALL 1971, AND REQUIRED SPACE FOR TWO STANDARDS

(Millions of Assignable Square Feet)

	Actual Total Non-Residential Space	Norris Standards	Actual Non-Residential Space Less Non-Class Labs	This Study, Augmented Standards
Public Institutions	531	543	493	451
Universities	266	268	232	191
Other Four-Year Schools	165	162	161	137
Two-Year Schools	100	113	100	123
Private Institutions	291	212	274	239
Universities	92	86	80	85
Other Four-Year Schools	184	118	179	139
Two-Year Schools	15	8	15	15

Note: See notes to Table D.

Source: See Table A; unpublished Opening Fall Enrollments, Fall 1971, courtesy NCES.

built since 1968, special retirement estimates were necessary. We estimate that, with present commitments through 1975, the stock of non-residential space will amount to 1,028 million assignable square feet. Retirements in the next 15 years will claim 68 million assignable square feet.

How adequate this stock might be will depend not only on the number of students, but on the character of programs in the post-secondary sector. A survey of innovative programs, technological developments, etc., did not encourage us to modify our projections of future requirements. We believe that, at best, the changes in the post-secondary system will be cosmetic; at worst, the system will not change in this decade or the next.

We could not see any effective way of helping proprietary schools catering to proprietary students through facilities programs. Most of these schools are small, and many go in and out of business in a few years. Their principal worry today is that proprietary enrollments are declining in the face of stiffening competition from public junior colleges. A federal policy to subsidize facilities of schools in this sector would be difficult to administer and would not address the fundamental problem of these schools.

Our survey of construction costs has convinced us that, under ordinary circumstances, they will continue to escalate one per cent faster than the cost of living. We are also convinced that the cost per assignable square foot was higher than required by mere concerns of providing minimum adequate space. Post-secondary schools are built with aesthetic values in mind.

In the last chapter of this study, we have tried to assess future space availability in the public sector, determine where space shortages could conceivably develop, and compare probable levels of demand for this space. Eight sets of projections of required space were prepared, using three approaches:

(1) Using standards for space developed by this study:

  (a) using these standards without any adjustment,

  (b) using these standards and adjusting for space required for technical programs,

  (c) augmenting estimates derived in (b) by an allowance for space in schools with campuses below 5,000 FTE students.

(2) Using the three estimates of space derived above to estimate the space required to accommodate the growth in enrollment between 1970 and 1975, 1980, 1985, and 1990.

(3) Estimating the amount of space needed

  (a) to eliminate shortages of space in schools in the public sector with space less than the standards developed by this study,

  (b) to provide adequate facilities for campuses which were projected to grow as increased enrollments in the public sector increase.

We prefer the third projection as being the most realistic. The first projection would result in sufficient space only if all schools had precisely the space they required. Surpluses in one school would cause shortages in another. The second projection is somewhat more realistic. It assumes that, since there was enough space on the average, space to accommodate new students is all that is needed. The third projection simulates reasonable campus planners' behavior, and is hence the best of the three.

Under any conceivable assumption, sufficient space will be available by 1975. If enrollments stabilize, hardly any building will be required from there on. If they do grow in line with the trends during the 1960's, modest additions to assignable space, at roughly two-thirds to one-half the rate of commitments during the past two years (when no general aid to construction was available), will be sufficient to meet the projected needs (see Table F).

In conclusion, we see no crisis in post-secondary facilities in the near future. We do see a challenge to minimizing the expenditures of this nation's resources. If it were possible to integrate excess space in the private sector into the public sector, the freed resources could be better applied elsewhere.

TABLE F

SUMMARY OF REQUIRED SPACE UNDER VARYING ASSUMPTIONS AND AVAILABLE SPACE, PUBLIC SECTOR, 1975 TO 1990

(Millions of Assignable Square Feet)

	1975		1980		1985		1990	
	Low	High	Low	High	Low	High	Low	High
	Enrollment Assumptions							
I Based on Study Standards								
(1) Study standards	404.9	494.5	452.4	541.6	448.8	557.2	421.7	551.5
(2) (1), with additional space for technical programs	437.2	512.3	488.6	584.9	484.0	600.9	454.9	595.0
(3) (2), and additional space for small schools	469.1	550.6	542.0	626.3	517.2	642.0	486.0	635.7
II Present Space Plus Space for New Enrollments								
(4) Space for new enrollments	45.7	121.3	97.4	194.9	93.1	211.4	63.7	113.7
(5) (4), present space, space for new enrollments and technical programs	549.7	625.3	601.4	698.9	597.1	715.4	567.7	617.7
(6) (5), including additional space for small schools	553.9	634.1	610.4	711.7	601.8	726.5	570.4	720.3

TABLE F (Cont'd.)

SUMMARY OF REQUIRED SPACE UNDER VARYING ASSUMPTIONS AND AVAILABLE SPACE, PUBLIC SECTOR, 1975 TO 1990

(Millions of Assignable Square Feet)

III Space Requirements Based on Present Space, Space Needed to Eliminate Shortages, and Provide for Technical Programs	1975		1980		1985		1990	
	Low	High	Low	High	Low	High	Low	High
			Enrollment Assumptions					
(7) Eliminate shortages, build new campuses, plus technical programs	543.3	571.0	593.1	697.2	n.a.	n.a.	n.a.	n.a.
(8) (7), plus size allowance	551.5	590.3	608.2	720.7	n.a.	n.a.	n.a.	n.a.
Available Space	639		627		614		587	

n.a.: Not applicable.

Source: See Chapter 11, p. 230.

CHAPTER 1

SCOPE OF REPORT

The report addresses a central issue in post-secondary education: how much space is likely to be needed to accommodate the enrollments between now and 1990 in both the non-profit and proprietary educational sectors. On the surface, this is a simple question, since a considerable volume of literature is available on the subject of desirable standards for facilities in the non-profit sector, and facilities in the proprietary sector constitute only a small portion of all the space required for instruction of post-secondary students.

A closer examination of the topic, though, reveals that projections of required space are not as simple as they seem. In the first place, there is considerable uncertainty about the levels of enrollments, both in the immediate future, say the next three to five years, as well as during the next two decades. Second, the requirements for space do not depend solely on the levels of enrollments, they are affected by the number of institutions and campuses which are operated. Possible economies of scale could make it possible to accommodate more students in a given amount of space on fewer campuses, as contrasted to fewer students with the same amount of space on more campuses. Third, the availability of a given amount of space does not guarantee that sufficient space will be available for all students--some institutions may have more space than required, and others may be short of space.

The problems of determining adequate space standards on a national scale is further complicated by different space requirements for different types of students, i.e., students in the sciences generally require more space than students in some other disciplines, and graduate students are believed to require more space than undergraduates. Even more importantly, the offerings of a post-secondary institution are likely to be affected by the type and amount of space available. It is quite likely that some institutions do not offer certain programs, or offer inadequate programs, because of total or specialized space shortages; thus, in some cases, present space standards may be irrelevant.

There are a large number of additional problems which affect the determination of adequate space utilization. This introductory chapter will attempt to give an overview of these problems, and indicate how they are likely to be handled in the body of the study.

Trends in Student Enrollments

Many observers of post-secondary education, as well as university planners and administrators, have lived all their adult lives during a period when post-secondary enrollments were growing apace. In the very recent past (some five years ago), it took real courage to forecast a slowdown in this rate of increase, and during the past year or so, increasing numbers of researchers have broached the possibility that enrollments may stabilize in the near future, and are likely to dip slightly during the 1980's.

Lower forecasts of future enrollments are based upon the observed decline of the birth rate, which will reduce the number of persons in the age group most likely to enroll in college. Furthermore, since both academic and financial barriers to college attendance were lowered during the past decade, a number of investigators have felt that the peak in the propensity to attend college is likely to be (or may even have been) reached. Whether this is the case or not remains a moot point.

It is true, though, that undergraduate enrollments during the past few years have not increased very fast, and that the degree of uncertainty about future enrollments has increased exponentially. As forecasts based on past trends were too high, doubts have been raised about the future prospects. These doubts are not shared by everybody in the post-secondary sector. Persons more optimistic about the future of higher education enrollments, mostly college administrators, argue that (1) the demand for post-secondary education will continue to grow as the affluence of the American population keeps increasing, and (2) that new recruits will be found for college admission, i.e., persons who may wish to return to college to expand their knowledge, update skills, or even retired persons desirous of acquiring new interests.

Current evidence does not support these optimistic proposals. It is not at all clear to what extent college education has been chosen by the majority of Americans as a way to enrich their lives, and to what extent it has been bought as an investment, either to improve earnings or marital prospects. If projections about the demand for college graduates are correct, the slight surplus of both college graduates and college-trained personnel over and above the number of jobs believed to be suitable for persons with college education will undoubtedly depress wages, and make college attendance less attractive. Also, the types of courses offered at both the undergraduate and graduate levels are not likely to appeal to retired persons, who are probably interested in less rigor and structure than is likely to be offered by most institutions.[1]

The types of institutions which students will decide to attend will also affect future space needs drastically. It has been generally believed that students in private institutions are provided with more space than students at public institutions; hence, at first blush, one would be led to believe that the shift from private to public institutions could result in less space requirements than would be manifested if more students attended private institutions. This may or may not be the case if enrollments in the private sector remain stable or decline and enrollments in the public sector grow. There may be excess space in one sector and shortages in another. As will be pointed out in the section on institutions, much depends also on the number of campuses to be operated.

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[1] Also, given the cost of attending most institutions, the drain on older persons' finances of commuting, fees, books, etc., is likely to be quite considerable in relation to their budgets. Hence, this market is more likely to be served by low-cost institutions, if at all. Strangely enough, some high-cost schools, e.g., Columbia, have announced continuing education programs in the humanities, oriented to this market.

Here, we shall merely note that not only the control of the school but also the type will play a role in determining space requirements. Thus, it appears that schools specializing in a narrower range of education, say, junior and community colleges, manage to be satisfied with less space requirements than four-year schools. In turn, universities require more space per student compared to either junior or community colleges or four-year schools. Parenthetically, it may be noted here that technical and engineering schools, as well as medical schools, have very different space requirements from other post-secondary institutions.

There is very little information about the extent of space requirements in the proprietary sector. Fragmentary information from selected schools indicates that both secretarial, data-processing, and other non-crafts schools manage with some 40 square feet per student. Craft schools, e.g., auto-mechanic, boiler-repair, or medical technician, require some 60 square feet per student. By contrast, television repair schools, which are generally small, make do with 15 to 20 square feet per student. In most cases, the schools provide little more than classroom/lab space, very limited faculty offices, and some administration space. With very few exceptions, the amenities of post-secondary institutions are dispensed with.

The above considerations have prompted us to prepare enrollment projections (1) for different levels of possible enrollments, (2) by control of institution, (3) by type of campus, and (4) by size of campus within type. Each one of these dimensions discussed below is relevant to the determination of space requirements.

Campus or Institution?

The plan to prepare projections in a disaggregated manner was adopted despite the fact that it causes a large number of data problems. For instance, there is no published series of enrollment by campus, and the series of enrollments by type of institution (an institution may consist of a large number of campuses) does not extend very far back either. The earliest data available from the Office of Education goes back only to 1963, and it does not distinguish between enrollments in public and private institutions. There is very little information either on a campus or institution basis that traces enrollments by size of institution for 10- to 20-year periods of time.

Under these circumstances, other ways of allocating students to schools had to be found. The one selected for this study assumes that the same proportion of students will attend campuses by size in future years as they do now, with the distribution within type of campus adjusted by the propensity to enroll in different types of institutions. Other methods, e.g., one which takes into account plans for establishing new campuses or institutions as reported by states, and trends past developments in the distribution of students by types of institutions/campuses, could have been used, and are discussed in the report.

Current Standards for Space

Perceived needs about the space for accommodating students undoubtedly influence existing space standards. What is believed to be right is used as a target to reach, given certain enrollment goals. We collected a variety of standards, studied the way they are derived, and interviewed administrators and planners of campuses to understand how they were applied in practice. A separate chapter in this report summarizes some of the more commonly used planning standards and discusses their adequacy and their usefulness for mapping national goals and projections.

Current Availability of Space

National inventories of space, when published, generally present averages by institution, by type and control, and sometimes by size of institution. This study goes much further: not only have we compiled data by size of campus, by type, by size, and by control, we have also calculated the distribution of space in each segment of the institution by quartile, with institutions ranked by the amount of space available. For each category of institution, we have further evaluated means and standard deviations for all space, and for space by type. This type of analysis gave us an opportunity to re-analyze the space availability for various types of campuses, and to pinpoint differences in space availability between campuses.

The analysis has focused upon the various types of space available--classroom, laboratory, general use, and special use space, as well as dormitory space. The hypotheses for the differences in available amounts of space are discussed in this chapter.

Determinants of Space Requirements

A number of hypotheses advanced in the previous chapter were later tested. The effect of various rates of space utilization were also discussed. Among the hypotheses tested statistically were the following: that space requirements (1) depend upon the mix of students (a) by level (graduate, undergraduate), and (b) by orientation of the institution (degrees granted in selected groups of disciplines); (2) are related to the number of faculty members per student; and (3) are affected by the level of expenditures per student for instructional purposes.

Some generalizations were drawn about future space requirements, given the results of these correlations.

Future Space Availability

Not all the space available today will be usable 20 years from now. Some of the space will become obsolete and have to be retired, and more will become so dilapidated that it will not be worth refurbishing. The experience with space retirement in the late 1950's and early 1960's was used to project the retirement rates for the next 20 years.

Proprietary Post-Secondary Education

An evaluation of the extent and the future of proprietary post-secondary education is presented. Some observations about space procurement are then made on the basis of (1) field visits, and (2) discussions with operators of proprietary schools. The flexibility of space acquisition by this sector is contrasted to the non-profit sector.

An Analysis of Costs of Space

Based upon information collected from selected state departments of education and a file from *College Management* magazine, estimates of costs per square foot of construction incurred in the past few years are presented. Future levels of construction costs, given the mix of facilities likely to be built, are discussed.

Some Comments on New Technology and New Patterns of Post-Secondary Education

Past trends are only relevant if the organization of the post-secondary sector is such that no change takes place. The possibility of new departures in post-secondary education, such as computer-assisted instruction, independent study, degrees by examination, etc., are discussed, and their impact on space assessed.

How Much Space Will Be Needed?

Alternative projections of space requirements are presented. The space requirement projections will vary, depending upon assumptions made about space utilization, enrollment growth, etc. Four various alternatives of required space are projected for the period 1975 to 1990.

CHAPTER 2

PROJECTIONS OF POST-SECONDARY ENROLLMENTS

How much space will be required for post-secondary institutions will depend on the number of students who will choose to enroll in these schools during the next two decades. Hence, an estimate of future enrollments is crucial to all forecasts of facilities requirements. A few years ago, it appeared that such an estimate would not require much courage to prepare. All one needed was patience and skill to analyze the past trends of enrollments by socio-economic class, by ability grouping, etc., and apply them to the prospective size of the high school graduating class. This procedure would forecast enrollments reasonably well. Even projections based on fitting least-square trends such as the ones prepared by the U.S.O.E.'s National Center for Educational Statistics appeared to perform fairly well in the short run during the late 1960's and early 1970's.

In both 1972 and 1973, though, the complacency of forecasters has been shattered. Actual fall enrollments for 1972 were below most projections, especially for degree credit undergraduates. An analysis of first-time enrollments for that year, based on the Current Population Survey (CPS), indicates a serious reversal in the propensity to enroll in college. While the proportion of high school seniors who attended post-secondary institutions in the year after graduation was increasing every year in the 1960's, first-year enrollments of seniors in 1972 were some 49 per cent of the graduating class, as contrasted to 54 per cent in 1969.[1]

A number of developments may have contributed to this decline, and the following questions need to be answered:

(1) Did the end of the draft and the Vietnam war affect the propensity to enroll?

(2) Was the decline in enrollments due to the drying up of certain kinds of student aid?

(3) Or, perhaps, were enrollment decisions affected by the unfavorable publicity about job prospects for college graduates?

Currently, there is no information about the influence of any of these or other developments on decisions to enroll. We do know, though, that the proportion of seniors enrolling in degree programs is down from most forecasts, the number of graduate and first-professional students is still increasing apace, and attendance in non-degree programs is booming. In the fall of 1972, the number of non-degree students was 13 per cent of pre-baccalaureate degree students in the United States. In the course of the past three years, their numbers were growing roughly 50 per cent faster than that of other undergraduates.

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[1] "The High School Class of 1972," by Ann M. Young, Monthly Labor Review, June 1973, Vol. 96, No. 6, p. 29.

An analysis of what has happened is further complicated by some drastic changes in the timing of enrollments which have occurred since 1965. A comparison of patterns from the 1960 Talent study with CPS enrollment analyses for the period 1965 to 1970 lead one to the conclusion that a larger proportion of students from poor families enrolled in college right after graduation in the late 1960's and the 1970's than in the 1950's and the early 1960's. Some modeling by this writer leads him to believe that in the early 1970's as many as 80 to 90 per cent of all full-time students from lower socio-economic groups enrolled in college in the year after high school graduation. Thus, the patterns of full-time attendance between the rich and the poor was significantly narrowed during the 1960's.

These changes in the attendance patterns and in propensities to enroll make past extrapolations and models inoperative. Models forecasting the future enrollments in post-secondary education have to be built from the ground up, and require more resources than have been made available to this project. Under these circumstances, we have decided to use two estimates of future enrollments. The high estimate assumes that the propensity to enroll will continue to go up between now and 1980, and will then level off with roughly 68 per cent of all high school seniors choosing to enroll in a degree credit post-secondary program at some time during their lifetime.[1] Our best judgment is that this is the maximum enrollment which could be expected during the next twenty years. This compares to some 62 per cent of all high school seniors who would be expected to enroll in college at 1969 enrollment rates, and the 56 per cent one would expect to enroll if past trends hold, given the levels of first-time enrollments in 1972.[2]

The high projection of enrollments also assumes that higher proportions of those receiving bachelor degrees will continue their education and attend professional and graduate programs. Based on recent developments, there is no reason to doubt that trend. Especially if the job prospects for B.A. recipients are unfavorable, the incentive to improve one's qualifications by participating in professional or graduate training may prove to be quite strong.

At the same time, there is reason to believe that the proportion of non-degree students to pre-baccalaureate degree students will continue to increase. Skill training, as part of career education models, is being increasingly promoted by federal and local authorities.

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[1] Joseph Froomkin, Aspirations, Enrollments, and Resources, The Challenge to Higher Education in the Seventies, U. S. Government Printing Office, Washington, 1970, Table B-VII, p. 122.

[2] Cf. Table B-IX, Ibid.

To reflect the increasing popularity of skill, non-degree training, an estimate was prepared by fitting a logistic curve to the ratio of non-degree to pre-baccalaureate students. The relationship of non-degree to pre-baccalaureate students was estimated at 17.6 per cent for 1990 and 12.4 per cent of all degree credit students. Between 1972 and 1990, the proportion of non-degree to pre-baccalaureate students was set to increase linearly at 1.7 per cent a year compounded. The aggregate levels of enrollments in terms of total students are shown in Table 2.1. This estimate of total students was based on the projection of enrollments in the post-secondary system, outlined in The Financial Prospects of the Post-Secondary Sector, 1975 to 1990.[1]

If past trends provide one a maximum estimate of enrollments, how is the lower estimate to be derived? It will be remembered that roughly 50 per cent of all high-school graduates between 1890 and 1950 participated in some post-secondary education.[2] It may be possible to set this as the trigger to estimate the lower level of future enrollments. We believe that this procedure would result in estimates which are much too low. As a result, we have estimated a level of undergraduate enrollments based on Fall 1972 enrollment trends, i.e., enrollments of some 50 per cent of all high-school graduates in the year after graduation, and a life-time participation rate in post-secondary education of some 56 to 58 per cent for high-school graduates. We also assumed that the propensity to enroll in graduate school would stay at roughly 1972 levels. In other words, the proportion of graduate students to the eligibles aged 23 to 29 would remain fairly constant. The proportion of non-degree students to pre-baccalaureate students was kept the same in both projections. The resulting estimates of total enrollments appear in Table 2.2.

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[1] Prepared under Contract HEW-OS-72-162, November 1972 by Joseph Froomkin, Inc.

[2] Aspirations, etc., op. cit., Chapter 2, esp. pp. 15ff.

While the higher projection of enrollments between now and 1985 indicates the growth in the workload of post-secondary institutions to be close to 26 per cent with a leveling of enrollments after that date, the low projection indicates that enrollments will be flat between now and 1975, will grow seven per cent between 1975 and 1981, the peak year, and will then decline ten per cent in the decade ending in 1990.

The two projections have widely differing implications for facilities construction. While the high projection implies that roughly 25 per cent more students will be enrolled in the peak period, namely 1981-82, the low projection forecasts a more modest topping out at some seven per cent in that year. In the short run, the high projection would call for much construction, the low one for very little.

The implications for the long run are also quite different. If the high projection proves correct, some replacement of obsolete facilities and buildings to offset retirements will be required between 1980 and 1990. By contrast, the low projection implies that very modest refurbishing and remodeling will suffice to meet the needs of post-secondary institutions during the later time period.

The aggregate projections may not accurately reflect facilities needs of post-secondary institutions. It is quite possible that one sector can either remain stable or decline, while another will grow quite rapidly. Separate projections appear below, showing our best estimates of enrollments by type of campus for four selected years: 1975, 1980, 1985, and 1990.

The distribution of enrollments by campus is adapted from the previously cited study (*The Financial Prospects of the Post-Secondary Sector, 1975 to 1990*). The projected enrollments in *Financial Prospects* were by college or university system, extrapolated from existing NCES data bases. In other words, a state network of post-secondary institutions, where one campus was classified as having strong doctoral orientation, but also included other four-year campuses and possibly two-year satellite locations, would be reported as a university. Another institution which is considered by the National

Center to have a less strong doctoral commitment, but which nevertheless grants a Ph.D., is classified as an "other-four-year-institution." Only independent community and junior colleges are classified as two-year institutions by the Center.

Since most of the succeeding analysis is based on an analysis campus by campus, rather than by institutional networks, the projections below have been adjusted in two ways:

(1) Campuses have been classified by their predominant orientation as of 1970-71, and

(2) All institutions granting a Ph.D., irrespective of the extent of their commitment to a doctoral program, have been classified as universities.

As a result of these changes, the majority of graduate students are now to be found in the category labeled "universities." The same observation can be made about first professional students. Roughly five per cent of university enrollments in the public sector were shifted to the two-year community college sector. A matrix showing these shifts appears in Table 2.3. It was assumed that the extent of these shifts would not change in the future.

The distribution of enrollments by type of institution for the high projection offers no surprises in the case of the private sector (Table 2.4). It was assumed that the total enrollments in that sector would remain stable throughout most of the period, i.e., to 1985, and would decline between 1985 and 1990, as the absolute number of enrollments in the public sector was assumed to remain stable, and the declines in enrollment were to be borne by the private sector. Towards the end of the time period, by 1990, institutions which offer graduate programs would probably suffer a smaller loss in enrollments, compared to those which offer only undergraduate instruction.

If the high projection turns out to predict enrollments, significant growth is likely to occur in the public sector. Two growth areas in this sector are: universities offering graduate degrees, which will experience considerable growth between now and 1980, and will stabilize thereafter; and two-year colleges, where the projected growth of some 40 to 50 per cent in full-time-equivalent students is projected between 1970 and 1980.

Recent experience gives no clues as to how either stable or declining enrollments are likely to affect distribution of students by institution. The experience of the depression of the 1930's and the falling post-secondary enrollments during World War II are hardly relevant in forecasting the distribution of students in the event that the propensity to enroll in college either moderates or declines.

Causes of declining enrollments are probably different today. If one of the important factors affecting decisions to enroll in college is the cost of attendance, it is quite likely that the lack of interest in a college education would affect the private sector more drastically than the public one. If, on the other hand, the decline in enrollments is due to the reluctance of low-achieving middle- and lower-class children to finance their education through debt, it is quite possible that the public sector could be affected more drastically than the private one.

Since considerable doubt surrounds the causes of current shifts in propensity to attend post-secondary institutions, we decided to allocate the lower enrollments in precisely the same proportion as the higher ones. In other words, it was assumed that all types of institutions would lose the same proportion of students by type. Care was taken to allocate the same proportion of pre-baccalaureate, non-degree, first-professional, and graduate students to each type of institution in both the high and low projections (see Table 2.5).

If the low enrollment patterns are to materialize, roughly 25 per cent more full-time-equivalent students will be registered in all public institutions in 1980, as compared to the early 1970's. By 1990, the enrollments will be some 15 per cent above those at the beginning of this decade.

In the private sector, we can expect drastic declines in enrollments, on the order of 15 per cent, between now and 1975, and a continuing decline of between 6 and 12 per cent for every succeeding five years. The declines will be less pronounced between now and 1985 in the university sector, and more drastic among the four-year colleges. The two-year junior college segment is relatively unimportant in total enrollments or as a share of enrollments in the private sector, and we would not be surprised if our projections underestimate the decline there.

TABLE 2.1

HIGH PROJECTION, TOTAL STUDENTS, BY YEAR

(Students in Thousands)

	Degree Credit	Non-Degree Credit	Total Enrollment
1970 (Actual)	7,868	653	8,521
1975	9,826	914	10,740
1976	10,090	959	11,049
1977	10,350	1,004	11,354
1978	10,542	1,033	11,575
1979	10,678	1,068	11,746
1980	10,739	1,095	11,834
1981	10,674	1,110	11,784
1982	10,577	1,121	11,698
1983	10,480	1,121	11,601
1984	10,394	1,143	11,537
1985	10,301	1,164	11,465
1986	10,350	1,190	11,540
1987	10,381	1,215	11,596
1988	10,412	1,239	11,651
1989	10,443	1,274	11,717
1990	10,474	1,299	11,773

TABLE 2.1 (Cont'd)

HIGH PROJECTION, TOTAL STUDENTS, BY YEAR

Source: Adapted from: J. Froomkin, Aspirations, Enrollments, and Resources, U. S. Department of Health, Education, and Welfare, Office of Education, U. S. Government Printing Office, Washington, 1970.

TABLE 2.2

LOW PROJECTION, TOTAL STUDENTS, BY YEAR

(Students in Thousands)

	Degree Credit	Non-Degree Credit	Total Enrollment
1970 (Actual)	7,868	653	8,521
1975	8,217	943	9,160
1976	8,378	971	9,349
1977	8,528	1,004	9,532
1978	8,660	1,029	9,689
1979	8,752	1,049	9,801
1980	8,814	1,071	9,885
1981	8,824	1,079	9,903
1982	8,777	1,086	9,863
1983	8,711	1,092	9,803
1984	8,653	1,089	9,742
1985	8,560	1,090	9,650
1986	8,430	1,089	9,519
1987	8,304	1,081	9,385
1988	8,179	1,079	9,258
1989	8,051	1,077	9,128
1990	7,929	1,074	9,003

Source: See Table 2.1, and p. 16.

TABLE 2.3

REALLOCATION OF STUDENTS, INSTITUTIONS TO CAMPUS

Public Institutions

Universities

+ .50 first professionals of public other four-year schools
+ .50 graduates of public other four-year schools
- .05 pre-baccalaureates and non-degrees of public universities

Other Four-Year Schools

- .50 first professionals of public other four-year schools
- .50 graduates of public other four-year schools

Two-Year Schools

+ .05 pre-baccalaureates and non-degrees of public universities

Private Institutions

Universities

+ .20 first professionals of private other four-year schools
+ .33 graduates of private other four-year schools
+ .05 pre-baccalaureates and non-degrees of private other four-year schools

Other Four-Year Schools

- .20 first professionals of private other four-year schools
- .33 graduates of private other four-year schools
- .05 pre-baccalaureates and non-degrees of private other four-year schools

Two-Year Schools

Unchanged

TABLE 2.3 (Cont'd)

REALLOCATION OF STUDENTS, INSTITUTIONS TO CAMPUS

Source: Comparison of HEGIS V analysis by campus with Fall Enrollment, 1970.

TABLE 2.4

DISTRIBUTION OF FULL-TIME-EQUIVALENT STUDENTS BY CAMPUS, 1975, 1980, 1985, AND 1990, HIGH PROJECTION

(Students in Thousands)

	1975			
	Pre-Baccalaureate and Non-Degree	First Professional	Graduate	Total
All Institutions	7,263	266	805	8,334
Universities	2,461	196	641	3,298
Other Four-Year Schools	2,755	70	164	2,989
Two-Year Schools	2,047	--	--	2,047
Public Institutions	5,811	127	575	6,513
Universities	2,004	119	465	2,588
Other Four-Year Schools	1,843	8	110	1,961
Two-Year Schools	1,964	--	--	1,964
Private Institutions	1,452	139	230	1,821
Universities	457	77	176	710
Other Four-Year Schools	912	62	54	1,028
Two-Year Schools	83	--	--	83

Note: Full-time-equivalent students are computed by equating three part-time students to one full-time student and adding it to full-time enrollment. This is consistent with NCES practice.

Source: Based on HEGIS V

TABLE 2.4 (Cont'd)

DISTRIBUTION OF FULL-TIME-EQUIVALENT STUDENTS BY CAMPUS, 1975, 1980, 1985, AND 1990, HIGH PROJECTION

(Students in Thousands)

	1980			
	Pre-Baccalaureate and Non-Degree	First Professional	Graduate	Total
All Institutions	7,783	385	950	9,118
Universities	2,690	262	730	3,682
Other Four-Year Schools	2,772	123	220	3,115
Two-Year Schools	2,321	--	--	2,321
Public Institutions	6,515	185	720	7,420
Universities	2,279	170	560	3,009
Other Four-Year Schools	1,992	15	160	2,167
Two-Year Schools	2,244	--	--	2,244
Private Institutions	1,268	200	230	1,698
Universities	411	92	170	673
Other Four-Year Schools	780	108	60	948
Two-Year Schools	77	--	--	77

TABLE 2.4 (Cont'd)

DISTRIBUTION OF FULL-TIME-EQUIVALENT STUDENTS BY CAMPUS, 1975, 1980, 1985, AND 1990, HIGH PROJECTION

(Students in Thousands)

	1985			
	Pre-Baccalaureate and Non-Degree	First Professional	Graduate	Total
All Institutions	7,663	500	1,070	9,233
Universities	2,634	320	801	3,755
Other Four-Year Schools	2,862	180	269	3,311
Two-Year Schools	2,167	--	--	2,167
Public Institutions	6,506	230	840	7,576
Universities	2,239	210	635	3,084
Other Four-Year Schools	2,175	20	205	2,400
Two-Year Schools	2,092	--	--	2,092
Private Institutions	1,157	270	230	1,657
Universities	395	110	166	671
Other Four-Year Schools	687	160	64	911
Two-Year Schools	75	--	--	75

TABLE 2.4 (Cont'd)

DISTRIBUTION OF FULL-TIME-EQUIVALENT STUDENTS BY CAMPUS, 1975, 1980, 1985, AND 1990, HIGH PROJECTION

(Students in Thousands)

	1990			
	Pre-Baccalaureate and Non-Degree	First Professional	Graduate	Total
All Institutions	7,409	580	1,055	9,044
Universities	2,582	370	768	3,720
Other Four-Year Schools	2,659	210	287	3,156
Two-Year Schools	2,168	--	--	2,168
Public Institutions	6,350	285	860	7,495
Universities	2,206	255	630	3,091
Other Four-Year Schools	2,053	30	230	2,313
Two-Year Schools	2,091	--	--	2,091
Private Institutions	1,059	295	195	1,549
Universities	376	115	138	629
Other Four-Year Schools	606	180	57	843
Two-Year Schools	77	--	--	77

Source: Based on: J. Froomkin, The Financial Prospects of the Post-Secondary Sector, 1975 to 1990, prepared under Contract HEW-OS-72-162, November 1972.

TABLE 2.5

DISTRIBUTION OF FULL-TIME-EQUIVALENT STUDENTS BY CAMPUS, 1975, 1980, 1985, AND 1990, LOW PROJECTION

(Students in Thousands)

	1975			
	Pre-Baccalaureate and Non-Degree	First Professional	Graduate	Total
All Institutions	6,215	225	674	7,114
Universities	2,106	165	537	2,808
Other Four-Year Schools	2,357	60	137	2,554
Two-Year Schools	1,752	--	--	1,752
Public Institutions	4,972	107	481	5,560
Universities	1,715	100	389	2,204
Other Four-Year Schools	1,576	7	92	1,675
Two-Year Schools	1,681	--	--	1,681
Private Institutions	1,243	118	193	1,554
Universities	391	65	148	604
Other Four-Year Schools	781	53	45	879
Two-Year Schools	71	--	--	71

TABLE 2.5 (Cont'd)

DISTRIBUTION OF FULL-TIME-EQUIVALENT STUDENTS BY CAMPUS, 1975, 1980, 1985, AND 1990, LOW PROJECTION

(Students in Thousands)

	1980			
	Pre-Baccalaureate and Non-Degree	First Professional	Graduate	Total
All Institutions	6,521	317	778	7,616
Universities	2,254	216	598	3,068
Other Four-Year Schools	2,324	101	180	2,605
Two-Year Schools	1,943	--	--	1,943
Public Institutions	5,458	152	590	6,200
Universities	1,910	140	459	2,509
Other Four-Year Schools	1,670	12	131	1,813
Two-Year Schools	1,878	--	--	1,878
Private Institutions	1,063	165	188	1,416
Universities	344	76	139	559
Other Four-Year Schools	654	89	49	792
Two-Year Schools	65	--	--	65

TABLE 2.5 (Cont'd)

DISTRIBUTION OF FULL-TIME-EQUIVALENT STUDENTS BY CAMPUS, 1975, 1980, 1985, AND 1990, LOW PROJECTION

(Students in Thousands)

	1985			
	Pre-Baccalaureate and Non-Degree	First Professional	Graduate	Total
All Institutions	6,195	398	845	7,438
Universities	2,128	255	632	3,015
Other Four-Year Schools	2,312	143	213	2,668
Two-Year Schools	1,755	--	--	1,755
Public Institutions	5,260	183	663	6,106
Universities	1,809	167	501	2,477
Other Four-Year Schools	1,757	16	162	1,935
Two-Year Schools	1,694	--	--	1,694
Private Institutions	935	215	182	1,332
Universities	319	88	131	538
Other Four-Year Schools	555	127	51	733
Two-Year Schools	61	--	--	61

TABLE 2.5 (Cont'd)

DISTRIBUTION OF FULL-TIME-EQUIVALENT STUDENTS BY CAMPUS, 1975, 1980, 1985, AND 1990, LOW PROJECTION

(Students in Thousands)

	1990			
	Pre-Baccalaureate and Non-Degree	First Professional	Graduate	Total
All Institutions	5,668	437	807	6,912
Universities	1,978	279	587	2,844
Other Four-Year Schools	2,033	158	220	2,411
Two-Year Schools	1,657	--	--	1,657
Public Institutions	4,857	215	658	5,730
Universities	1,690	192	482	2,364
Other Four-Year Schools	1,569	23	176	1,768
Two-Year Schools	1,598	--	--	1,598
Private Institutions	811	222	149	1,182
Universities	288	87	105	480
Other Four-Year Schools	464	135	44	643
Two-Year Schools	59	--	--	59

Source: See Table 2.4.

CHAPTER 3

SIZE DISTRIBUTION OF INSTITUTIONS AND CAMPUSES

The considerable uncertainty about the level of future enrollments outlined in the previous chapter makes it imperative to project the distribution of students by size of campus. Enrollments in some segments of the post-secondary sector may increase while they decrease in others, and changes in the distribution of students by type and size of campus can produce space shortages or surpluses. Hence, in order to estimate future space requirements, it is important to project likely distributions of students not only by type and control of institution, but also by size of institution or campus.

Since the objectives of this project were (1) to estimate desirable levels of space in different types of higher education institutions, (2) to evaluate the impact of past financing patterns upon attainment of these standards, and (3) to suggest a method for estimating future requirements to accommodate expected levels of enrollments, the first step in our research was to identify a system for classifying different types of institutions which would have similar space requirements, and to project likely enrollments by type and size of institution.

Much of the analysis below is based upon facilities information reported in HEGIS V (1970-71). The information has been checked for consistency with data reported in HEGIS IV, and a small number of records which appear to be inconsistent from one reporting to another were eliminated. More than 98 per cent of the records were retained.

The traditional way in which data is reported classifies higher education institutions into clusters catering to different levels of students. Thus, all junior colleges are grouped together, so are all four-year institutions; universities comprise another grouping. Generally, a distinction is made as to the control of an institution, in which all institutions financed by state and local governments are reported as public and those financed by private or religious sources are considered private.

The simplicity of this classification is more seductive than useful. It isn't at all clear what the relevant unit for analysis should be. Is it better to examine space availability campus by campus, or to analyze aggregated data for several campuses forming one institution, e.g., a state system which may include a university, satellite liberal arts colleges, and a few junior colleges? Although the U.S.O.E. chooses the latter system for most of its reports, an analysis of data from HEGIS V leads us to the conclusion that it is probably more logical to deal with the data on a campus-by-campus basis. One major reason is that there is no uniformity among the states on how they classify the several campuses. Some states group a large number of campuses under the aegis of one institution, others favor independent arrangements, either for single campuses or for a network of similar campuses.

Available Historical Data

Past history on enrollments by size and/or type of institution collected by the U.S.O.E. is extremely spotty. The earliest data are for 1960 and 1963. Enrollment by size was published for all schools in 1960, and in 1963 for the then-current scheme of eight different types of institutions. The tables do not provide total enrollments in each category, and lump all schools of more than 10,000 students into one size group. The data tapes or source data underlying these tables are, of course, not readily available. The acquisition and processing of them, if they still exist, was judged too costly, both in time and money.

More detailed tables were published for Fall 1968 to Fall 1970. These tables are based on the Opening Fall Enrollment Survey and show the number of institutions and the degree-credit enrollment for nine size breaks of institutions, ranging from under 200 to over 30,000 students. In addition to size, the data are reported by control and type of institution.

All tables of enrollment by type, control, and size of institution have to be used with caution because of the following four caveats:

(1) Only degree-credit enrollment is reported. Thus, enrollment in two-year institutions is somewhat understated.

(2) Reported enrollments are total head counts, and do not distinguish between full-time and part-time students.

(3) The classification by size is on an institutional basis rather than campus by campus. For instance, the University of Maine is reported as one institution. In fact, it consists of eight campuses. One offers a doctorate, one a master's degree, four a baccalaureate degree, and two are junior colleges.

(4) In order to qualify for the designation of a university, the institution concerned has to have a major commitment to a doctoral program, and at least two professional schools.[1] Thus, a large number of institutions which offer doctorate programs are not included in that category.

In summary, there are little meaningful data to trace the past growth of institutions. Hence, projections of the size distributions of institutions in the future have to be, of necessity, of an impressionistic and imprecise nature.

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[1] The Financial Prospects of the Post-Secondary Sector, 1975 to 1990, prepared for the Office of ASPE, DHEW (Contract HEW-OS-72-162), November 1972.

Using the Past to Understand the Future

Just because the data collected to date aren't in the form which we would find desirable doesn't mean that they cannot give us certain insights into the way in which institutions have grown. We have tried to use it as imaginatively as we know how to try to understand and estimate future growth patterns.

When faced with a great deal of uncertainty about the relevance of the data, it is useful to compare more sophisticated projections against a naive model which assumes either (a) that things will remain the same in the future, or (b) they will change at the same rate that they have in the past. First, we have used enrollment projections prepared in connection with a study performed for the Assistant Secretary for Planning and Evaluation, Department of Health, Education, and Welfare.[1] We allocated these enrollments and an estimated number of institutions projected for 1980 by state commissions for higher education[2] according to the 1970 distribution by size. No institutions were added beyond 1980 because of the levelling off of enrollments after that date.

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[1] Also Financial Prospects, op. cit.

[2] Richard A. Holden, An Estimate of Construction Needs of Higher Education by 1980, U. S. Department of Health, Education, and Welfare, Office of Education, Bureau of Higher Education, Washington, D. C., August 1971.

This method suffers from a number of weaknesses. It doesn't permit institutions to be re-allocated from one size group to another. Consequently, if the number of institutions is not increased in some cases, then the average enrollments in a cell exceed the limits for the enrollment size category. Nevertheless, it can be used to show the effects of a trend projection of the distribution of students by size of institution.

A second way of constructing a naive model is to assume that a certain number of institutions will shift from one cell size to another as enrollment grows. Using the data from 1968 to 1970, the probability of an institution moving from a smaller to a larger size group was calculated in relation to the growth of enrollment. These propensities for change were then used to forecast both the number and the size distribution of institutions in future years. This method, of course, is subject to a very valid criticism. Projections for twenty years ahead are made on the basis of three years' experience. A thin reed, indeed, to make projections.

Hence, we tried a third, and more sophisticated, method to project enrollment patterns. The cumulative per cent of enrollments and institutions in each size group were charted for the period 1960 to 1970, for all those years with data on size distribution of institutions. For 1968 to 1970, curves could be drawn by type of control of institution. In earlier years, less detail was available. There was some change in the shape of the curve from 1960 to 1970, but amazing stability in the shape of the curves in the face of a 12 per cent growth in enrollment between 1968 and 1970. The size groups accounted for relatively the same cumulative per cent of institutions and enrollments in both 1968 and 1970 for all type and control groups. Over the long haul, 1960 to 1970, the middle-sized institutions appeared to grow faster than either the very small or very large ones.

Of course, some judgments must be made as to what type of relation will hold true in the face of future increases or decreases in enrollments. The relative stability of the general shape of the curve in the face of a 60 per cent increase in enrollments between 1963 and 1970 would prompt us to assume that the relative size distribution of institutions will remain fairly stable. As an illustration, the resulting distribution of students by size and type of public institution, using each one of the three methods, is shown in Table 3.1.

Some Further Refinements in the Classification of Data by Campus

As has been stated earlier, one objective of our project is to estimate space requirements in homogeneous institutions. Hence, the campus-by-campus reports of HEGIS V can profitably be classified finer than they have been to date.

As stated earlier, the U.S.O.E. reports often classify several related campuses as one institution of the type and control of the main campus. Our first adjustment was to designate each campus on the basis of the highest degree offered. Thus, those granting doctorates were considered universities, those with less than a four-year program became two-year schools, and the remaining campuses became other-four-year schools.

These adjustments produced some shifts in the distribution by size and type from what U.S.O.E. reported by institution. The differences are detailed in Table 3.2.

Further adjustments were made when our early investigation of the data showed that a large number of doctorate-granting institutions are small divinity schools. These were separately coded, segregated, and ignored in the analysis below. Another group of schools eliminated were U. S. Service Academies.

Size Distribution of Schools

At the very outset of our research, we attempted to enforce a similar size distribution of schools or universities, four-year schools, and junior colleges. We soon found that this classification was unsuitable. In order to have a reasonable number of schools in each single cell, it was necessary to adopt another more reasonable size classification for each type of school. For instance, in the case of universities, we chose three size groups, based on FTE enrollment: under 10,000 students, 10,000 to 20,000 students, and over 20,000 students. In the case of public four-year campuses, our size breaks are: under 2,500; 2,500 to 5,000; 5,000 to 10,000; and over 10,000 FTE enrollment. For private four-year schools and all junior colleges, the size breaks are different again, since very few have enrollments of 5,000 or more. The size classifications the number of campuses, and total FTE enrollment in each cell are shown in Table 3.3.

TABLE 3.1

PROJECTED DISTRIBUTION OF PUBLIC POST-SECONDARY INSTITUTIONS BY SIZE AND TYPE

A. Based on Fall 1970 Distribution

Size Group	Number of Institutions			Average Degree-Credit Enrollment		
	1970	1980	1990	1970	1980	1990
Universities						
Less than 10,000	19	22	22	8,042	10,600	10,527
10,000 to 20,000	31	35	35	16,300	21,283	21,137
20,000 to 30,000	19	22	22	24,737	31,486	31,268
Greater than 30,000	25	28	28	48,800	64,646	64,200
Total	94	107	107	25,001	32,533	32,308
Other Four-Year Schools						
Less than 1,000	36	39	39	633	872	985
1,000 to 2,500	72	76	76	1,829	2,574	2,904
2,500 to 5,000	78	83	83	3,714	5,184	5,849
5,000 to 10,000	95	101	101	7,081	9,891	11,159
10,000 to 20,000	49	52	52	12,816	17,938	20,240
Greater than 20,000	11	11	11	25,418	37,745	42,591
Total	341	362	362	5,937	8,306	9,372
Two-Year Schools						
Less than 1,000	191	234	234	599	761	708
1,000 to 2,500	221	271	271	1,595	2,025	1,884
2,500 to 5,000	123	151	151	3,537	4,479	4,166
5,000 to 10,000	73	90	90	6,823	8,603	8,002
Greater than 10,000	46	57	57	15,261	19,144	17,807
Total	654	803	803	3,214	4,076	3,791

TABLE 3.1 (Cont'd)

PROJECTED DISTRIBUTION OF PUBLIC POST-SECONDARY INSTITUTIONS BY SIZE AND TYPE

B. Based on Changes, 1968 to 1970

Size Group	Number of Institutions			Average Degree-Credit Enrollment		
	1970	1980	1990	1970	1980	1990
Universities						
Less than 10,000	19	19	19	8,042	9,653	9,589
10,000 to 20,000	31	14	14	16,300	19,564	19,429
20,000 to 30,000	19	19	19	24,737	29,690	29,484
Greater than 30,000	25	42	42	48,800	58,567	58,157
Total	94	94	94	25,001	37,034	36,777
Other Four-Year Schools						
Less than 1,000	36	53	59	633	615	620
1,000 to 2,500	72	51	45	1,829	1,969	2,036
2,500 to 5,000	78	66	61	3,714	4,003	4,143
5,000 to 10,000	95	112	118	7,081	7,621	7,886
10,000 to 20,000	49	91	104	12,816	13,796	14,275
Greater than 20,000	11	19	22	25,418	26,457	27,200
Total	341	392	409	5,937	7,676	8,299
Two-Year Schools						
Less than 1,000	191	146	154	599	803	758
1,000 to 2,500	221	270	262	1,595	1,819	1,772
2,500 to 5,000	123	174	168	3,537	4,029	3.924
5,000 to 10,000	73	101	97	6,823	7,781	7,578
Greater than 10,000	46	70	66	15,261	16,649	16,106
Total	654	761	747	3,214	4,285	4,067

TABLE 3.1 (Cont'd)

PROJECTED DISTRIBUTION OF PUBLIC POST-SECONDARY INSTITUTIONS BY SIZE AND TYPE

C. Based on Cumulative Distributions of Institutions

Size Group	Number of Institutions			Average Degree-Credit Enrollment		
	1970	1980	1990	1970	1980	1990
Universities						
Less than 10,000	19	15	15	8,042	7,653	7,607
10,000 to 20,000	31	24	24	16,300	18,425	18,292
20,000 to 30,000	19	35	36	24,737	25,957	25,447
Greater than 30,000	25	33	32	48,800	61,076	62,119
Total	94	107	107	25,001	32,533	32,308
Other Four-Year Schools						
Less than 1,000	36	35	32	633	860	903
1,000 to 2,500	72	53	38	1,829	2,272	2,366
2,500 to 5,000	78	71	69	3,714	3,814	3,691
5,000 to 10,000	95	102	104	7,081	8,112	7,866
10,000 to 20,000	49	84	96	12,816	14,687	15,171
Greater than 20,000	11	17	23	25,418	30,976	32,474
Total	341	362	362	5,937	8,312	9,379
Two-Year Schools						
Less than 1,000	191	205	215	599	669	650
1,000 to 2,500	221	288	358	1,595	1,940	2,071
2,500 to 5,000	123	145	77	3,537	4,101	4,934
5,000 to 10,000	73	112	108	6,823	8,605	8,554
Greater than 10,000	46	52	44	15,261	19,477	19,409
Total	654	802	802	3,214	4,074	3,789

TABLE 3.2

COMPARISON OF POST-SECONDARY INSTITUTIONS AND CAMPUSES, FALL 1970

	Institutions (U.S.O.E.)	Campuses (This Study)*
Universities	159	326
Public	94	164
Private	65	162
Other Four-Year Schools	1,506	1,438
Public	341	345
Private	1,165	1,093
Two-Year Schools	891	1,042
Public	654	796
Private	237	246

*In this study, all campuses granting doctorate degrees are included under the heading of universities. Only those institutions with major doctoral commitments are classified as universities by U.S.O.E.

Source: See Table 2.3, p. 25

TABLE 3.3

NUMBER OF CAMPUSES

(1970 Actual, 1975 to 1990 Projected)

A. Public Sector

	1970	1975		1980		1985		1990	
		Low	High	Low	High	Low	High	Low	High
Universities									
Less than 10,000	85	90	90	90	50	90	60	90	60
10,000 to 20,000	58	65	40	45	72	47	72	52	72
More than 20,000	22	25	50	45	68	43	58	38	58
Total	165	180	180	180	190	180	190	180	190
Other Four-Year Schools									
1,000 to 2,500	159	135	110	110	90	100	80	103	80
2,500 to 5,000	94	100	120	100	110	120	100	110	115
5,000 to 10,000	72	100	110	115	120	120	140	115	125
More than 10,000	20	25	30	35	55	30	65	32	60
Total	345	360	370	360	375	370	385	360	380
Two-Year Schools									
Less than 1,000	354	300	220	230	255	300	225	320	225
1,000 to 2,500	274	360	395	395	350	360	330	350	330
2,500 to 5,000	113	125	215	165	235	125	210	115	210
More than 5,000	55	65	70	70	100	65	85	60	85
Total	796	850	900	860	940	850	850	845	850

TABLE 3.3 (Cont'd)

NUMBER OF CAMPUSES

(1970 Actual, 1975 to 1990 Projected)

B. Private Sector

		1975		1980		1985		1990	
	1970	Low	High	Low	High	Low	High	Low	High
Universities									
Less than 10,000	149	149	147	149	149	152	149	154	149
10,000 to 20,000	10	10	12	13	10	10	10	8	10
More than 20,000	3	3	3	0	3	0	3	0	3
Total	162	162	162	162	162	162	162	162	162
Other Four-Year Schools									
Less than 1,000	758	597	677	457	610	388	580	288	540
1,000 to 2,500	282	250	282	230	270	240	260	230	240
2,500 to 5,000	46	42	46	36	45	34	44	30	39
More than 5,000	7	7	7	7	7	5	7	3	7
Total	1,093	896	1,012	730	932	667	891	551	826
Two-Year Schools*									
Less than 1,000	229	157	194	145	157	140	157	135	157
More than 1,000	17	15	15	15	15	15	15	15	15
Total	246	172	209	160	172	155	172	150	172

* Based on projected rate of closing.

Source: See p. 43

CHAPTER 4

SPACE REQUIREMENTS - CURRENT PERCEPTION OF NEED

Space requirements for post-secondary students are expressed in terms of square feet per student, either for total space, or for each type of space provided in post-secondary institutions. Generally, this ratio has as its denominator full-time-equivalent students. On occasion, full-time, or full-time day students are considered appropriate.

Underlying each space requirement estimate are a number of assumptions about (1) the size of the student station, or the space required to accommodate an activity, a faculty member, etc., and (2) the utilization rates for the space, e.g., the per cent of stations in a room, or study spaces in a library. For assembly areas, theaters and gymnasiums, student unions, and similar space, there exists an undocumented consensus of what is necessary to sustain the ambiance of a given type of college campus. For leading universities, space requirements are complicated by the necessity to set aside space for specialized laboratories often used for organized research, and, if additional senior staff is hired to man research projects, for additional office space.

Information about Space Standards

The space standards developed in this study were based on a study of existing space standards, either advocated by different authorities, or published by state planning agencies.[1] A great help in reconciling and arriving at new subjective state standards presented here were interviews with a large number of space planners. We owe a special debt to Mr. William S. Fuller, of the New York State Education Department, Mr. Harlan Bareither, of the University of Illinois, and Mr. Donovan Smith, of the University of California at Berkeley. In addition, a large number of both university-based and state-based officials concerned with space spent a considerable time explaining the needs of colleges and universities. Although we are grateful to all of them, the responsibility for space standards derived in this chapter is solely ours, and does not necessarily reflect their opinions.

Classification of Space

Although different space planning authorities advocate minor variations in the manner post-secondary space ought to be reported, the space classification scheme published in the DHEW, USOE, Higher Education Facilities Classification and Inventory Procedures Manual is generally accepted. This classification is the result of a cooperative effort of many experts, including campus architects, planning consultants, and state officials charged with planning campus development.

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[1] For space utilized, see footnotes in Tables 4.1 and 4.3.

The manual uses these principal classifications in characterizing non-residential facilities in post-secondary institutions: classrooms, laboratories, offices, general use, special use, and support space. While each of these categories is further subdivided into sub-categories, for purposes of this study we have decided not to break down the space classifications into finer detail, except in one instance. Space used for organized research, i.e., non-class laboratories and their ancillary facilities, are treated separately in this study.

The major categories are reported in this study as they have been recorded by the HEGIS space survey. The decision not to alter this scheme was made after perusing the literature on space planning, and talking to a number of space planners. We also decided that further sub-classification of space would serve little purpose because many respondents to the HEGIS must resort to an educated guess in order to assign space to a particular sub-category when filling out the questionnaires. We also found out that in many instances major categories of space had multiple uses, and their classification was moot. For instance, in a number of smaller schools, gymnasiums are used as assembly space, thus blurring the distinction between special use and general use space. In some state schools, assembly halls and theaters are used as classrooms for large sections of introductory courses. Since the distinctions among certain major categories of space are often more apparent than real, no useful analytical purpose would be served by gilding the lily and analyzing space by finer breaks.

Classroom Space

Although classroom space accounts for less than 10 per cent of the total non-residential space in most schools, it has received more than its share of attention in the discussion of space needs. One could be charitable and ascribe this emphasis to the concern placed on academic features of campus life, or cynical and ascribe the attention to the ease with which standards can be formulated.

There is fair agreement that a classroom student station is between 14 and 16 square feet. The average between these two figures, 15 square feet, has been used by many space planners. Generally, smaller institutions have reported larger student stations, probably because they build average-size rooms, have smaller classes, and provide for fewer students per room. Also some institutions with large graduate enrollments allow 20 to 24 square feet per station in seminar rooms. Even if no seminar rooms are provided, graduate students are believed to require more space per student. This is sometimes ascribed to the need for a table in a seminar room, and at other times because rooms are of an average size and graduate sections are small. Some space planners told us that, as the proportion of graduate students to total students increases in the future, it is likely that the size of graduate sections will increase, and graduate students will not require more space than undergraduates.

Most master or aggregated plans for classrooms do not distinguish between classroom space requirements of graduates and undergraduates because these space differences are dwarfed by differing practices in planning for space utilization. The amount of space needed depends upon (a) the number of hours classrooms are utilized, and (b) the per cent of stations in utilized classrooms which are occupied. As a general rule, target hours for classrooms are set at 30 - 36 hours. The occupancy is usually set at 55 to 65 per cent of available seats in the classrooms being utilized.

Recently the California legislature has set higher standards, 66 hours a week, for classroom utilization. The station occupancy rate was set very much lower than usual, though, at 34 per cent. According to some authorities, this could be considered as the upper limit for utilization of classrooms.

The ground rules for classroom space based upon hours of utilization and station occupancy fall short of describing a viable national standard for a number of reasons. The most obvious is that one would expect basic differences in space utilization among different types of institutions. Thus, campuses with significant numbers of part-time students who attend courses after 5:00 PM have a significant opportunity to extend the usage of classrooms above the set standards. Institutions which cater predominantly to full-time students apparently cannot schedule classes at late hours or weekends without experiencing lower enrollments per class section compared to classes scheduled during the daylight hours, Monday through Friday.

Our field trips have convinced us that no institution had classroom shortages in the evenings. Thus, it seems more reasonable to plan classroom availability for daytime students. A general rule of thumb, providing space for all full-time students, most of whom are day students, may be a better measure than planning classroom availability on a full-time-equivalent basis.

Another factor which vitiates the usefulness of the class planning standards is the size of the campus. Generally, smaller campuses have more trouble scheduling large rooms than do campuses with larger enrollments. Some authorities have suggested excluding classrooms with more than 100 seats in calculating space standards for small campuses, others have suggested an allowance for smaller campuses. There is no standard for this reduction, but in practice smaller campuses do have more space per student than larger campuses.

Thirdly, plans for classrooms are generally made on the assumption that either all student contact hours, or student contact hours other than those in laboratories, are held in classrooms. This is not the case. A number of studies have documented that between 10 and 20 per cent of all student contact hours are held outside of either classrooms or laboratories. Auditoriums or chapels and gymnasiums have a large proportion of these classes. In campuses with significant agricultural programs, some classes are held outdoors. Schools with graduate programs conduct some classes in faculty offices and studios, and provide opportunities for self study.

Lastly, the credit hours earned in laboratories have to be subtracted from the credit or contact hours in classrooms. An analysis of usage rates of laboratories and classrooms in the Ohio and Indiana state systems prompted us to adopt an estimate of 1.2 credit hours per FTE student taken in laboratories.

Thus, the classroom space required per full-time student, on the realistic assumption that the full-time credit load is 15 credit hours, of which 12.3 hours are taken in classrooms, is (12.3 x 15 ft/sta) 185 square feet. At 30 hours and 60 per cent occupancy, it is 10.3 square feet. Using the California standard, the classroom space to be provided is 8.2 square feet. The ratio of FTE to full-time students is roughly .85. Hence, a lower figure is consistent with a standard based on an FTE load. Some 10.0 square feet per full-time student, and somewhat less per FTE student, appears to be a reasonable, if not generous, standard (see Table 4.1).

Laboratories

Estimating classroom requirements is fairly straightforward, compared to the approximations which have to be made to come up with national estimates of required laboratory space. In the first place, different disciplines have different requirements for space per student station for laboratory space. Second, assignment practices of laboratory space vary discipline by discipline for students at different levels, and school by school.

Surprisingly, there is no generally accepted grouping of disciplines to establish planning factors for the square feet required for laboratories. In some cases, sub-disciplines are lumped together; in others, considerable detail is available. Three typical listings, showing the amount of detail, are shown in Table 4.2.

The variations of laboratory space by discipline cannot fail to convince one that space requirements for a given school cannot be forecast accurately without considerable detailed knowledge of course offerings. In most supporting materials accompanying master plans for new or expanded colleges, such projections are usually included. The accuracy of these forecasts, unfortunately, is open to question because they are based on both the current demand for courses and majors and the ability of the faculty to meet this demand.

During our interviews, space planners confirmed the suspicion that changes in job prospects for college students are affecting space utilization of laboratories. Space set aside for engineering and physics majors is under-utilized in some schools, and there are shortages of space in biology and computer laboratories. The difficulty of planning space demand for a given course was graphically illustrated during our visit to the Berkeley campus of the University of California. Demand for the elementary economics course jumped from 400 to 1,000 from one quarter to the next. Only 600 were accommodated. On the same campus, shortages of biology lab space have resulted in waiting lists for the elementary biology course.

The inability to increase the usage of laboratories is difficult for a casual observer to understand. Generally, laboratories are scheduled for 20 to 24 hours a week with 75 to 80 per cent projected occupancy. The low hourly utilization rates are a result of a variety of practices which result in limiting the usage of laboratories. Generally the number of clock-hours is highest in laboratories used by undergraduates. There, such practices as providing storage space for each user at each station sometimes limit the utilization. The practice of providing an individual station to each student limits the utilization rate even more. Special arrangements of this sort are much more common as the students progress through school. Hence, the utilization declines for laboratories set aside for upper-level undergraduates and graduate students (see Table 4.3).

In the case of graduate students, class clock-hours are not an adequate measure of laboratory usage because in a number of schools space is set aside for graduate students' research. At least one school, the University of California at La Jolla, affords this luxury to undergraduates.

The variation of usage rates, mix of disciplines, etc., makes it extremely difficult to estimate needs. Table 4.3 shows the wide range of estimated requirements which were collected from various sources. These ranges can be compared to those derived from the following calculation:

Average credit hours earned in laboratories	1.2
Average clock hours to earn 1.2 credits	2.4
Assumed average station size	60 sq. ft.
Utilization for 24 hours at 80 per cent, requirement per student	7.5 sq. ft.

This estimate brackets fairly well the low and high estimates provided by some states (see Table 4.3). It should be noted, though, that the efficiency of lab space in producing credit hours is much lower than that of classroom space. For instance, 0.7 square feet of classroom space produces one credit hour. By contrast, 6.2 square feet of lab space are required to produce the same credit hour in laboratories. Thus, laboratory space is only 0.11 times as "efficient" a producer of credit hours as classroom space. This is another way of validating the fact that schools with heavy science programs require much more space than the average.

Study Space

Study space, according to HEGIS definitions, contains space for the storage of books, the processing of library acquisitions, as well as student carrels, reading rooms, etc. The standards for book storage and processing are fairly straightforward. Most space planners suggest 0.085 to 0.100 net available square foot per volume in the collection. These figures, we believe, also allow for additions to the collection for the next five years.

There is less agreement on how much reading room and space should be provided. Some authorities would provide simultaneous seating for a fifth of the student body, others for one-third. The standards also vary by level of student, with more space reserved for upper-level undergraduates, and still more for graduate students. The average seems to be roughly 5.0 net available square feet per student, allowing seats in the library for 25 per cent of all students.

It is usual to allow an additional 20 to 25 per cent of both stack and reading room space for processing acquisitions and for administration.

Since a considerable fraction of the space requirements in this category depends upon the size of the collection, standards for space are best determined by taking the size of the collection into account. This has been done in Column 4 of Table 4.4, where estimates of volumes per FTE were adapted from yet-unpublished U.S.O.E. statistics on library holdings. U.S.O.E. statistics provided information on average library holdings in the 25th, 50th, and 75th percentile of institutions, thus making it possible to estimate the ranges in space needed for the collections. In addition, provisions were made for study space to accommodate simultaneously 25 per cent of FTE students, and for administrative space taken as 25 per cent of the two categories above. Table 4.4 summarizes the standards calculated for various types of schools. The ranges for institutions in the 25th and 75th percentiles are shown in the range column.

The above space requirements should be increased for a number of schools which locate newer methods of information retrieval in the library. The space requirements for microfilm machines or microfiche readers, estimated by space planners at 50 to 60 square feet per station (including storage), do not add considerably to space requirements. Generally, one machine per 500 students is provided. By contrast, the space requirements for the audio collection, especially if both playback equipment and language-laboratory stations are located in the library, and for the imaginative plans in some schools of centralizing computer-assisted instruction in the library complex could add considerably more space to the standards. In at least one college plan, production facilities for audio and video tapes were also included in library planning. The transformation of the study center into a teaching-information-video center could conceivably increase space requirements by nearly 10 per cent. The justification for this estimate is shown in Table 4.5.

Office Space

The standards for calculating office space per faculty member are fairly straightforward. Each faculty member is provided with a 120-square-foot office. Generally, one secretary is provided per five full-time faculty members. Space for a secretary and the reception area accounts for 150 square feet, i.e., some 30 additional square feet per faculty member. Give or take 10 per cent, these figures are universally accepted as standards. Here the agreement stops; some planners add some 10 square feet per professor for storage space; others also provide for 20 - 25 square feet of conference room space. As a general rule, though, between 160 and 200 net available square feet per full-time instructional staff member appears to bracket requirements quite adequately.

The requirements for additional space for part-time faculty and graduate students, some of them serving as part-time instructors, are less clearly articulated. Some authorities believe that 60 square feet of space per part-time instructor should be provided. Since generally a part-time instructor is one-third of a full-time member, the full-time equivalent of faculty multiplied by full-time faculty space requirements will probably result in a good estimate of needed office facilities.

In the case of graduate students, two approaches are used: (1) allowing for more study space in the library, say 10 square feet, i.e., part of a carrel, or (2) providing for shared offices, some 30 or 40 net available square feet per doctoral student. The practice of authorities varies by the orientation of their school, with schools with a major commitment to the doctorate degree, which de-emphasize intermediate degrees, providing more space.

Even more complicated is the estimation of space requirements for administrators. There is a consensus that every president or chancellor of an institution (irrespective of the institution's size) deserves 2,000 square feet of space. Space allocations to professional administrators are similar to those made to full-time faculty. Generally, though, they are supported by larger numbers of clerical and secretarial personnel, who can be accommodated in 60 square feet of space each.

As a general rule, since professionals in the administration are either a minority or, at most, half of the staff, some 90 net available square feet per administrative staff person appears to be adequate. It comes out to roughly 180 square feet per administrative professional. This is the median figure for teaching staff as well. Hence, 180 square feet, give or take 10 per cent, appears a reasonable standard of office space per FTE professional.

Special Use Space

Special use space, as defined in the U.S.O.E. manual, includes armories, athletic facilities, stadiums, audio-visual production facilities, on-site schools used for practice teaching, greenhouses, and patient testing and examination rooms, generally those limited to psychologists.

There is very little possibility of establishing standards for so diverse a collection of space. Even in some of the more clear-cut uses of space, e.g., gymnasiums, standards may vary between 5 and 10 net available square feet, depending upon the commitment of the college to the sports program (Space Guide, Office of Campus Planning and Development, The City University of New York, January 29, 1973).

In schools where football is important, even more space may be available.

It is in this type of space that the rule, referred to by some space planners as the "one of each" rule, applies. Every school would like to have at least one gymnasium with an Olympic pool, etc., etc. Reality often conspires to make do with less. Thus many schools, even those with the ROTC programs, combine the gymnasium and armory. Others manage to find unused space in dormitories to set up a radio- or small TV-transmission studio. What is considered adequate depends upon what is customary in other schools which are considered to fall within the "peer" group. Thus, for instance, New York City College guidelines for space are strongly influenced by standards set for New York state colleges, even though the city university is set in the midst of the largest metropolitan area in the country, and many state colleges are in non-metropolitan settings. Special use facilities in private colleges, if our impression is correct, are haphazardly planned. Much depends upon the whims of donors.

There can be no hard and fast rules about how much space is required. In Table 4.6, we have shown, for different types and sizes of institutions, the average net available square feet per full-time-equivalent student and for those institutions where over-40 campuses were reported, the mean space, and the space in the second and third quartile.

General Use Space

Assembly facilities, theaters, exhibition halls, museums, restaurants, cafeterias, student unions, and bookstores are all included in general use space. Here again, the "one of each" syndrome determines the space to be provided. Some schools make do with theaters (or chapels) for assembly areas, while the presence or absence of a museum or exhibition area depends upon the character of the school.

Currently, small schools aspire to at least one theater, and large ones try to build two of them. Space requirements for these facilities are flexible, and depend, again, on the presence or absence of a performing arts program.

Food catering facilities also depend on the character of the school. Residential schools, with food catering part of the dormitories, may wish to provide for a larger proportion of the student body to be seated simultaneously, as compared to commuter schools. Generally, about 12 square feet are allowed per eating station in a cafeteria, and at least as much for food preparation and storage. A modest standard of, say, 20 - 25 per cent of all students, faculty, and staff to be provided with simultaneous seating could add 6 square feet per FTE to space requirements. The demand for institutional space facilities depends, of course, upon the availability of competing food facilities in the neighborhood. These vary from location to location, and no general rules can be specified.

In Table 4.6, we have shown available general use facilities in the "average" school, as well as the "average" in the quartile above and below the median. Either one of these standards could be used nationally.

Medical Space

Medical space, other than the one used for training medical or nursing students, is generally trivial. Consideration of medical space is not included here. A short discussion dealing with medical schools is included in the next chapter.

Support Space

Various shops and services, as well as heating and electric plant, are included under this category. Parking is also included in this category, and so is data processing.

Most importantly, a number of schools, in reporting this space, have left this entry blank, so that standards derived from statistical averages for this category are not very relevant.

Data processing and parking deserve special comment. Data processing facilities depend upon both the administrative and the research activities in a school. In some instances, specialized equipment is included in research space.

The role of parking areas in space planning should not be underestimated, especially on commuter campuses. If parking is provided for 20 per cent of the students and faculty, the space required may amount to half as much as is provided for classrooms. Depending on location and climate, either covered or open-air parking may be provided. It is unclear if open-air parking facilities are even recorded in HEGIS. Some schools do not provide any parking, forcing students to park on the street.

Some space planners, when faced with our query about reasonable allowance for support space, have opted for an allowance of 10 per cent of the total space.

Total Non-Residential Space

A number of authorities and individuals have estimated total non-residential space requirements for different types of institutions. The most often cited, and generally referred to as the Norris Standards, were derived by the Higher Education Construction Programs Study Group, led by Chalmers G. Norris. This group came up with the following targets per FTE:

	NASF
Public universities	132
Public other four-year schools	93
Public two-year schools	70
Private universities	150
Private other four-year schools	103
Private two-year schools	75

These standards are considerably above the ones adopted by a number of state planning agencies. For instance, the State of Ohio sets a standard of 75 net assignable square feet for all schools, except Ohio State University where the target is set at 90 net assignable square feet per full-time-equivalent student. New Jersey space planning standards fall within the same range, except that over 100 square feet per FTE are provided in engineering schools. In New York, the master plan provides for 94.6 net available square feet for community colleges, or roughly 80 square feet per full-time-equivalent student. As can be seen from the above, there is considerable variation about what may be considered adequate or desirable.

The standards derived by this study from the opinions of state facility planners, summarized in Table 4.7, fall within these ranges. They are generally lower than the Norris standards, and somewhat higher than the standards set by the states. Since we have tried to reflect the consensus rather than extremes of opinion, these results are not surprising. The ranges of 90 - 120 net assignable square feet per FTE student for public and private universities are not strictly comparable to the Norris standards, since they (1) exclude the organized research space, which could add roughly 5.0 per cent to the total space requirements, and (2) ignore special requirements of medical, technological, and engineering schools, which are treated separately in our study. On the other hand, the estimates for four-year schools are roughly comparable to the Norris standards, and do not differ from them by more than five per cent.

The standards derived in this study can perhaps best be used to estimate the incremental needs for space in the future. The average space required to house existing technical, medical, and other programs, as well as to provide for facilities for additional students, may possibly be somewhat more than the one indicated by the standards in Table 4.7. In some cases, as in private junior colleges, the reliance on current practice probably overestimates needed space. Many of these schools have been losing students and are space rich.

TABLE 4.1

SELECTED STANDARDS FOR CLASSROOM SPACE IN COLLEGES AND UNIVERSITIES

	No. of Hours Utilization	Per Cent Occupancy When in Use	Square Feet Per FTE[1]
Florida[2]			
State University System[2]	36	60	8.5
Community Colleges			
Less than 2,500 FTE	36	55	9.3
2,500 or more FTE	36	70	7.3
California[3]			
1966	34	66	8.2
Recent	66	34	8.2
CUNY[4]			
Senior Colleges	30	89	6.9
Community Colleges	30	67	9.2
University Space Planning[5]	30	60	10.3
Arkansas[6]	30	60	10.3
Colorado	30	67	9.2
Kentucky	31	66	9.0
Nebraska	30	65	9.5
Texas	30	55	11.2

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[1] Square feet per FTE is based on an example of 12.8 credit hours in the classroom per FTE and 15 square feet per FTE. The

TABLE 4.1 (Cont'd)

number of hours in the classroom may vary, and a new standard re-calculated according to the following formula:

$$\text{Square feet per FTE} = \frac{\text{Weekly contact hours in classroom per FTE} \times \text{square feet per station}}{\text{Hours per week} \times \text{per cent occupancy per hour of use}}$$

[2] Reported by State Board of Education, Tallahassee. These standards are used to estimate demand for space and capital budget outlays. They are not necessarily strictly applied to all construction projects once the funds are appropriated.

[3] 1966 Standards: Franklin G. Matsler, Space Utilization Standards, California Public Higher Education. A report to the Coordinating Council for Higher Education, Sacramento, 1966. Recent legislative action reported by State Legislative Committee on Facilities.

[4] Space Guides, Office of Campus Planning and Development, Department of Space Planning and Management, City University of New York, 1973.

[5] Harlan D. Bareither and Jerry L. Schillinger, University Space Planning, Urbana: University of Illinois Press, 1968.

[6] State standards reported in Planning Standards, Inventory and Utilization Data for Higher Education Facilities in Twenty-Seven States, Bureau of Higher Education, Facilities Comprehensive Planning, State Education Department, Albany, New York, 1970.

TABLE 4.2

SELECTED EXAMPLES OF CLASS LABORATORY SPACE STANDARDS

Part A. California State Colleges and Universities

	Upper Division		Lower Division	
	Assignable Sq. Ft./Stations	Assignable Sq.Ft./ Weekly Student Contact Hour	Assignable Sq. Ft./Stations	Assignable Sq.Ft./ Weekly Student Contact Hour
Agriculture	60	2.8	60	3.75
Biological Sciences	55	2.6	60	3.75
Physical Sciences	60	2.8	70	4.4
Mathematics	30	1.4	30	1.9
Engineering	90	4.25	110	6.9
Psychology	40	1.9	60	3.75
Other Social Sciences	30	1.4	30	1.9
Art	65	3.0	65	4.0
Other Humanities	40	1.9	40	2.5
Business Administration	30	1.4	30	1.9
Education	--	---	40	2.5
Home Economics	60	2.8	60	3.75
Journalism	60	2.8	60	3.75
Health Sciences	--	---	50	3.2

u = under study, still undetermined

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TABLE 4.2 (Cont'd)

SELECTED EXAMPLES OF CLASS LABORATORY SPACE STANDARDS

Part B. City University of New York

Department	Lab/Studio	NASF/Stn	NASF/WSCH Lab.	NASF/WSCH Svc.	NASF/WSCH Total	NASF/WSCH Ancillary
Life Sciences:						
Biology	Elementary	50	2.60	.94	3.54	1.57
	Advanced	50	2.60	.94	3.54	1.57
Nursing	General	40	2.08	u	u	u
M.C.P.E. Sciences:						
Astronomy	General	50	2.60	.53	3.13	.70
Chemistry	General	50	2.60	.94	3.54	1.24
	Organic	50	2.60	.94	3.54	1.24
	Advanced	60	2.13	.62	3.75	1.24
Computer	General	32	1.66	.42	2.08	u
Engineering	General	100	u	u	5.20	u
	Electrical	65	u	u	3.39	u
	Civil	112	u	u	5.83	u
	Mechanical	160	u	u	8.33	u
	Industrial	160	u	u	8.33	u
Math	General	40	2.08	0	2.08	0
	Statistics	40	2.08	0	2.08	0
Physics	Elementary	50	2.60	.94	3.54	.71
	Advanced	50	2.60	.94	3.54	.71

TABLE 4.2 (Cont'd)

SELECTED EXAMPLES OF CLASS LABORATORY SPACE STANDARDS

Part B. City University of New York (Cont'd)

Department	Lab/Studio	NASF/Stn	NASF/WSCH Lab.	NASF/WSCH Svc.	NASF/WSCH Total	NASF/WSCH Ancillary
Geology	Elementary	50	2.60	.94	3.54	1.24
	Advanced	50	2.60	.94	3.54	1.24
Behavioral Sciences:						
Anthropology	Phys. Anthr.	30	1.56	.52	2.08	.47
	Archaeology	30	1.56	.52	2.08	.47
Economics	General	32	1.66	.42	2.08	0
Geography	General	50	2.60	.94	3.54	0
History	General	25	1.30	.36	1.66	0
Psychology	Elementary	30	1.56	.78	2.34	.53
	Advanced	50	2.60	.94	3.54	.81
Sociology	General	32	1.66	.42	2.08	.47
Humanities:						
Art	Design	60	3.13	.59	3.72	.74
	Drafting	40	2.08	1.56	3.64	.72
	Painting	40	2.08	.52	2.60	.52
	Sculpture	50	2.60	.94	3.54	.71

TABLE 4.2 (Cont'd)

SELECTED EXAMPLES OF CLASS LABORATORY SPACE STANDARDS

Part B. City University of New York (Cont'd)

Department	Lab/Studio	NASF/Stn	NASF/WSCH Lab.	NASF/WSCH Svc.	NASF/WSCH Total	NASF/WSCH Ancillary
Performing Arts	Drama	32	1.66	0	1.66	u
	Dance	100	5.20	0	5.20	u
	Theater	100	5.20	0	5.20	u
Speech	General	40	2.08	0	2.08	u
Language	Special	25	1.30	0	1.30	0
Linguistics	General	60	3.13	0	3.13	0
Music	General	48	2.50	0	2.50	u
	Ensemble	30	1.56	0	1.56	u
	Piano	30	1.56	0	1.56	u
	Choral	20	1.04	0	1.04	u
Professions:						
Accounting	General	32	1.66	0	1.66	.17
Administration	General	40	2.08	0	2.08	.17
Architecture	General	65	3.39	2.08	5.47	u
	Drafting	40	2.08	1.56	3.64	u
Education	General	30	1.56	1.56	3.13	.62
	Art	35	1.82	1.04	2.86	.57
	English	20	1.04	.66	1.70	.34
	Math	20	1.04	.52	1.56	.31

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TABLE 4.2 (Cont'd)

SELECTED EXAMPLES OF CLASS LABORATORY SPACE STANDARDS

Part B. City University of New York (Cont'd)

Department	Lab/Studio	NASF/Stn	NASF/WSCH Lab.	NASF/WSCH Svc.	NASF/WSCH Total	NASF/WSCH Ancillary
Education (cont'd))	Music-Dance	50	2.60	1.56	4.16	.83
	Reading	70	3.65	3.13	6.78	1.35
	Science	40	2.08	.52	2.60	.52
	Social Studies	20	1.04	.66	1.70	.34
Dental Hygiene	General	60	3.13	1.56	4.69	u
Home Economics	General	70	3.65	1.56	5.20	2.60
Management	Time & Motion	40	2.08	0	2.08	.41
Marketing	General	50	2.60	0	2.60	.52
Library Science	General	40	2.08	0	2.08	u
Technical-Vocational:						
Fashion	General	80	4.16	1.04	5.20	u
Secretarial	General	40	2.08	0	2.08	u
Technology	Aerospace	80	4.16	1.04	5.20	u
	Construction	80	4.16	1.04	5.20	u
	Engineering	80	4.16	1.04	5.20	u
	Design	80	4.16	1.04	5.20	u
	Data Processing	32	1.66	.42	2.08	.73
	Health	70	3.64	1.56	5.20	u

TABLE 4.2 (Cont'd)

SELECTED EXAMPLES OF CLASS LABORATORY SPACE STANDARDS

Part C. University Space Planning

Field of Study	NASF/Stn, Inc. Auxiliaries	NASF/WSH 20 Hours per Week; 80 Per Cent Station Utilization	NASF/WSH 24 Hours per Week; 80 Per Cent Station Utilization
Agriculture			
Agriculture Engineering	100	10.00	8.33
Agronomy	70	4.38	3.64
Animal Science	160	10.00	8.33
Dairy Science	68	4.25	3.54
Food Science	96	6.00	5.00
Forestry	65	4.06	3.39
Home Economics	100	6.25	5.21
Horticulture	65	4.06	3.39
Plant Pathology	65	4.06	3.39
Commerce and Business Administration			
Accountancy	32	2.00	1.67
Business Education	32	2.00	1.67
Economics	32	2.00	1.67
Finance	32	2.00	1.67
Business Administration	32	2.00	1.67
Industrial Administration	32	2.00	1.67
Marketing	32	2.00	1.67

TABLE 4.2 (Cont'd)

SELECTED EXAMPLES OF CLASS LABORATORY SPACE STANDARDS

Part C. University Space Planning (Cont'd)

Field of Study	NASF/Stn, Inc. Auxiliaries	NASF/WSH	
		20 Hours per Week; 80 Per Cent Station Utilization	24 Hours per Week; 80 Per Cent Station Utilization
Education			
Education Administration and Supervision	32	2.00	1.67
Educational Psychology	65	4.06	3.39
Elementary Education	32	2.00	1.67
History and Philosophy of Education	32	2.00	1.67
Secondary and Continuing Education	32	2.00	1.67
Vocational and Technical Education	65	4.06	3.39
Engineering			
Aeronautical and Astronautical Engineering	160	10.00	8.33
Ceramic Engineering	112	7.00	5.83
Civil Engineering	112	7.00	5.83
Electrical Engineering	65	4.06	3.39
General Engineering	32	2.00	1.67
Mechanical Engineering	160	10.00	8.33
Industrial Engineering	160	10.00	8.33
Mining Engineering	160	10.00	8.33

TABLE 4.2 (Cont'd)

SELECTED EXAMPLES OF CLASS LABORATORY SPACE STANDARDS

Part C. University Space Planning (Cont'd)

Field of Study	NASF/Stn, Inc. Auxiliaries	Net Assignable Sq. Ft./Weekly Student Hours	
		20 Hours per Week; 80 Per Cent Station Utilization	24 Hours per Week; 80 Per Cent Station Utilization
Metallurgy Engineering	160	10.00	8.33
Petroleum Engineering	160	10.00	8.33
Nuclear Engineering	160	10.00	8.33
Physics	65	4.06	3.39
Theoretical and Applied Mechanics	160	10.00	8.33
Fine and Applied Arts			
Architecture	65	4.06	3.39
Art[1]	60	3.75	3.13
Band	48	3.00	2.50
Landscape Architecture	65	4.06	3.39
Music Laboratories	48	3.00	2.50
Theater	100	6.25	5.21
Urban Planning	65	4.00	3.39
Journalism			
Advertising	48	3.00	2.50
Journalism	48	3.00	2.50
Radio and TV	96	6.00	5.00

TABLE 4.2 (Cont'd)

SELECTED EXAMPLES OF CLASS LABORATORY SPACE STANDARDS

Part C. University Space Planning (Cont'd)

Field of Study	NASF/Stn, Inc. Auxiliaries	NASF/WSH	
		20 Hours per Week; 80 Per Cent Station Utilization	24 Hours per Week; 80 Per Cent Station Utilization
Liberal Arts and Sciences			
Anthropology	50	3.13	2.60
Astronomy	50	3.13	2.60
Botany	50	3.13	2.60
Chemistry	68	4.25	3.54
Entomology	50	3.13	2.60
Geography	68	4.25	3.54
Geology	68	4.25	3.54
Microbiology	68	4.25	3.54
Physics	65	4.06	3.39
Physiology	68	4.25	3.54
Psychology	50	3.13	2.60
Sociology	30	1.88	1.56
Speech	32	2.00	1.67
Zoology	50	3.13	2.60
Library Science	48	3.00	2.50

TABLE 4.2 (Cont'd)

SELECTED EXAMPLES OF CLASS LABORATORY SPACE STANDARDS

Part C. University Space Planning (Cont'd)

Field of Study	NASF/Stn, Inc. Auxiliaries	NASF/WSH	
		20 Hours per Week; 80 Per Cent Station Utilization	24 Hours per Week; 80 Per Cent Station Utilization
Physical Education			
Physical Education for Men	250	11.00[2]	9.16
Physical Education for Women	250	11.00[2]	9.16
Recreation	32	2.00	1.67
Health and Safety	64	4.00	3.33
Dance	250	11.00[2]	9.16
Armed Forces[3]			
Air Force Science	32	2.00	1.67
Military Science	32	2.00	1.67
Naval Science	32	2.00	1.67

[1] Studios calculated with research space requirements.

[2] Usage based on facilities being scheduled as well as classrooms from 7:00 AM to 4:00 PM and 80 per cent station utilization.

[3] Drill Hall not included.

TABLE 4.2 (Cont'd)

SELECTED EXAMPLES OF CLASS LABORATORY SPACE STANDARDS

Source: Franklin G. Matsler, Space Utilization Standards, California Public Higher Education, A Report to the Coordinating Council for Higher Education, Sacramento, 1966. Recent legislative action reported by State Legislative Committee on Facilities.

Space Guides, Office of Campus Planning and Development, Department of Space Planning and Management, City University of New York, 1973.

Harlan D. Bareither and Jerry L. Schillinger, University Space Planning, Urbana: University of Illinois Press, 1968.

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TABLE 4.3

LABORATORY SPACE STANDARDS FOR SELECTED INSTITUTIONS AND STATES

	Square Feet per FTE
Staten Island Community College[1]	22.88
New York State University Centers[2]	17.80
Florida Community Colleges[3]	
Non-Occupational, less than 2,500	13.10
Non-Occupational, more than 2,500	11.46
Occupational/Technical	34.07

	Square Feet per FTE	
	High[4]	Low[4]
Arkansas[5]	7.51	--
California	22.56	3.36
Colorado	14.02	7.06
Delaware	10.80	7.20
Illinois	26.40	3.74
Kentucky	7.70	4.94
Montana	27.65	5.26
Oklahoma	18.00	6.00
South Carolina	24.00	4.80
Texas	11.52	5.76

[1] Staten Island Community College Master Plan, 1975, Appendix to the Master Plan Report, City University of New York, 1971.

[2] Reported by State.

[3] Reported by State Board of Education, Tallahassee. These standards are used to estimate demand for space and capital budget outlays. They are not necessarily strictly applied to all construction projects once the funds are appropriated.

TABLE 4.3 (Cont'd)

[4] Square feet per FTE is based on a case of 2.4 clock hours in the lab per FTE. The number of hours in the lab may vary and a new standard be re-calculated according to the following formula:

$$\text{Square feet per FTE} = \frac{\text{Weekly contact hours in lab per FTE} \times \text{square feet per station}}{\text{Hours per week} \times \text{per cent occupancy per hour of use}}$$

[5] State standards reported in *Planning Standards, Inventory and Utilization Data for Higher Education Facilities in Twenty-Seven States, Bureau of Higher Education, Facilities Comprehensive Planning*, State Education Department, Albany, New York, 1970.

TABLE 4.4

STUDY SPACE STANDARDS

	Study Space (25 Per Cent FTE Seating Capacity) (000 Sq. Ft.)	Stack Space (.083 Sq. Ft. per Volume) (000 Sq. Ft.)	Administrative & Miscellaneous Space (25 Per Cent of Study & Stack) (000 Sq. Ft.)	Total Space per FTE (Sq. Ft.)	Range Due to Varying Size of Collection (Sq. Ft.)
Public Institutions					
Universities	12,150	8,923	5,268	13.55	±2.0
Four-Year	10,225	4,427	3,663	11.21	±1.0
Two-Year	8,825	1,326	2,538	8.99	±0.5
Private Institutions					
Universities	3,600	6,068	2,417	21.05	±4.0
Four-Year	7,000	7,543	3,636	16.25	±3.0
Two-Year	675	349	256	11.74	±1.0

Source: See p. 61

TABLE 4.5

ESTIMATED SPACE REQUIREMENTS FOR INSTRUCTIONAL RESOURCES CENTER, STATEN ISLAND COMMUNITY COLLEGES

	Net Square Feet
Instructional Resources Center	13,560
Less: Space included in library	8,620
Additional space required	4,940
Library	54,175
Additional space as per cent of library space	9.1%

Source: *Staten Island Community College Master Plan, 1975, Appendix to Master Plan Report*, City College of New York.

TABLE 4.6

AVERAGE SPECIAL USE, GENERAL USE, AND SUPPORT SPACE PER FTE STUDENT IN POST-SECONDARY INSTITUTIONS, BY TYPE, CONTROL, AND FTE ENROLLMENT WITH AVERAGES FOR SECOND AND THIRD QUARTILES, FALL 1970

(NASF per FTE)

	Special Use Space			General Use Space			Support Space		
	Mean	Second Quartile	Third Quartile	Mean	Second Quartile	Third Quartile	Mean	Second Quartile	Third Quartile
Public Universities									
Less than 10,000	18.87	10.51	19.83	19.76	15.64	22.09	11.01	8.68	11.04
10,000 to 20,000	14.87	10.01	14.46	14.24	11.42	14.17	12.18	7.14	12.03
20,000 or more	13.75	*	*	13.22	*	*	13.36	*	*
Private Universities									
Less than 10,000	19.83	10.65	17.98	32.30	18.25	31.05	17.39	8.32	14.02
10,000 to 20,000	11.59	*	*	19.73	*	*	16.96	*	*
20,000 or more	8.13	*	*	8.11	*	*	*	*	*
Public Other Four-Year Institutions									
Less than 2,500	17.80	10.09	18.04	22.90	14.25	23.90	8.63	4.74	8.89
2,500 to 5,000	14.52	8.91	14.68	17.76	13.20	20.10	7.08	4.40	7.50
5,000 to 10,000	13.98	9.87	14.74	14.08	11.95	16.58	5.68	3.66	6.10
10,000 to 20,000	7.03	*	*	6.45	*	*	5.55	*	*
Private Other Four-Year Institutions									
Less than 1,000	24.67	11.44	22.90	48.84	36.55	52.69	16.67	6.73	14.77
1,000 to 2,500	21.76	14.61	23.03	37.67	29.40	40.39	14.03	7.02	13.41
2,500 to 5,000	13.65	8.36	13.91	23.34	15.99	23.45	7.43	3.89	6.88
5,000 to 10,000	6.28	*	*	13.13	*	*	*	*	*

TABLE 4.6 (Cont'd)

	Special Use Space			General Use Space			Support Space		
	Mean	Second Quartile	Third Quartile	Mean	Second Quartile	Third Quartile	Mean	Second Quartile	Third Quartile
Public Two-Year Institutions									
Less than 1,000	17.49	1.81	15.29	12.55	6.63	11.88	4.77	0.66	2.52
1,000 to 2,500	9.73	2.79	9.76	9.08	4.49	9.63	4.69	1.16	3.01
2,500 to 5,000	6.97	5.36	8.28	6.97	4.92	7.67	2.62	1.36	2.57
5,000 or more	5.78	5.15	6.69	5.61	4.74	6.14	3.00	1.94	3.10
Private Two-Year Institutions									
Less than 1,000	32.04	5.02	24.88	43.06	27.43	48.66	16.16	3.43	11.71
1,000 to 2,500	11.77	*	*	18.66	*	*	9.03	*	*
2,500 or more	9.63	*	*	14.17	*	*	*	*	*

Source: HEGIS V.

Note: * Fewer than 10 cases.

TABLE 4.7

SPACE STANDARDS DERIVED IN THIS STUDY PER FULL-TIME-EQUIVALENT STUDENT

(Net Available Square Feet)

	Classroom Space	Laboratory Space	Office Space	Special Use Space	General Use Space	Support Space	Study Space	Total
Public Institutions								
Universities	9.0	6.7	18.0	15.2	14.9	12.4	13.6	89.8
Other four-year schools	8.8	6.6	11.0	13.1	14.6	6.4	11.2	71.7
Two-year schools	7.6	5.7	9.4	8.7	7.8	3.5	9.0	51.7
Private Institutions								
Universities	8.7	6.5	24.0	16.0	25.5	16.1	21.1	117.9
Other four-year schools	9.1	6.8	15.9	20.6	37.7	13.4	16.3	119.8
Two-year schools	9.3	7.0	15.8	25.9	35.2	13.5	11.7	118.4

Source: See p. 70.

CHAPTER 5

A COMPARISON OF SPACE TO SPACE STANDARDS

The conventional use of space standards derived by consensus is to compare them to the amount of space actually available in different types of institutions, and to conclude from the comparison whether space shortages or surpluses do exist. This chapter, at the very outset, describes such a conventional comparison, with the additional refinement of comparing average available space not only by type and control of institution, as was done in previous studies, but also by grouping institutions by size for a given type and control. As will be explained below, to add precision to this study, additional types of institutions, those with special programs, have been isolated to make the analysis more meaningful.

This analysis is followed by a more detailed examination of space available to schools within a given type, control, and size category, when schools were grouped into quartiles after being ranked on total non-residential space. These data help pinpoint possible shortages of space in categories where the average space available appears adequate because some institutions or campuses have much more space than the standards, and others have much less. We believe that this breakdown of institutional space gives better insights into the adequacy of space than the conventional analysis.

Lastly, we report on an attempt to trace the incremental differences among different types of space, as total non-residential space in different institutions, classified by type, control, and size, in institutions with different amounts of space. The purpose of this analysis was to find consistent patterns of space acquisition by institutions, as the total availability of space increases for a given type of institution.

The conclusions of this chapter are only moderately helpful to the policy planners. For instance, there did not appear to be a general shortage of space, if the fairly modest space standards established in Chapter 4 are compared to space availability. By contrast, some 15 to 25 per cent of institutions did have shortages of space in some category for which firm standards could be established.

The acquisition of additional space, by type, did not follow a clearly consistent pattern. Two hypotheses may be advanced to explain this variation: (1) the needs of different institutions are so different that no generalization is possible, and (2) institutions which are space-poor and those which are space-rich expand their instructional space for different reasons, the former to accommodate students, the latter to expand programs. The ones which are neither too space-poor nor too space-rich, on the other hand, put a much higher priority upon expansion of non-instructional space, generally to round off the amenities on their campuses.

Despite the fact that this chapter does not present unassailable findings about how much space is required or available, it does contribute to the understanding of how space is distributed. The analysis of distribution of space by quartile, and the high standard deviations which are associated with it, indicates that a variety of arrangements are possible to deliver post-secondary education to different mixes of students.

Classification of Schools

The analysis below is based upon schools which reported facilities in the HEGIS V (1970-71). The information contained in that survey is on a campus-by-campus basis. Thus, a given university system, either of a given state or locality, may report more than one campus in this survey. For instance, the University of Maine operates a campus where graduate studies are offered, as well as a series of four-year and two-year campuses. Each one of these campuses is treated separately in the analysis below.

Campuses have been subdivided into the following categories:

(1) Junior colleges

(2) Four-year schools

(3) Universities and schools offering doctoral degrees

(4) Medical, dental, pharmaceutical, or osteopathic schools

(5) Universities with medical schools on the same campus

(6) Special technical schools

(7) Agricultural

(8) Arts, and arts and crafts schools

Excluded from the analysis were schools of divinity, U. S. government service schools, and a few schools (mostly those with small enrollments) with questionable data.

Each of these categories of schools was further subdivided by control and, whenever the number of institutions was large enough to warrant it, by size group.

A Comparison of Inventories of Facilities with Planners' Standards

It is possible to visualize a number of alternative ways of comparing inventories of space available as of 1970-71 with the planners' standards. The most straightforward is to compare each type of space to the available standards for a given group of institutions, either subdivided by size group or for all institutions of a given type. This procedure has been followed traditionally to estimate possible space shortages or excesses.

This method has a large number of shortcomings, not the least of which is to mask shortages in certain institutions, because campuses with little space are aggregated with campuses which may have space over and above the standards believed to be adequate. This chapter, after comparing averages by type of campus (and size), further breaks down availability of space by quartile within each type of campus, with campuses being ranked from low to high by the availability of a given type of space. This analysis makes it possible to highlight the campuses with shortages or surpluses of space.

Aggregate Comparisons of Space and Inventories

The aggregate comparisons of space standards with the space available show few shortages by type or size of institution, especially for those categories of space where very specific space standards have been established, i.e., classrooms, laboratories, and office space. In the aggregate, there appear to be some shortages of space in libraries. If special use, general use, and support space are aggregated, the rule of thumb suggested by a number of space planners--that this type of space should amount to some 35 - 40 per cent of the total non-residential space--indicates that few shortages, in the aggregate, exist in these categories either. It should be noted that standards in Chapter 4 do not obey this rule and are somewhat more generous (see Table 5.1).

Classroom Space. Once the classroom space is adjusted by the relationship of part-time to full-time students, the space standard which was expressed as 10.0 square feet per full-time student now varies between 7.6 square feet in junior colleges, with a high proportion of part-time students, to 9.1 square feet in private four-year schools, where 90 per cent of the students are full-time. On the average, there are no shortages of classroom space in any of the institutions, with only large public four-year schools close to the lower limit.

Laboratory Space. In the case of laboratory space, where adjusted standards per FTE vary from 9.1 to 13.6 square feet of space, there appear to be some shortages in private junior colleges and the three largest universities. In this latter case, the shortages may be more apparent than real, because two out of three schools have large part-time programs which are not reflected in the standards which assume the same proportion of part-time students in all schools in a given category, and which may overstate the need in these three universities.

Classroom and Laboratory Space. Since the demand for classroom and laboratory space is a joint demand, and depends upon programs which are offered in a given school, it may even be more reasonable to compare the total space available for both purposes in relation to the standards. Since we have estimated that laboratory space is only 0.11 times as efficient as classroom space in producing a standard credit hour, it would be sensible to adjust these two to a common standard. This has been done in Table 5.2.

Again, on the average, when these two types of space are aggregated, there appear to be no shortages of space.

Office Space. The situation is more complex with respect to standards based upon full-time-equivalent students. In the case of office space, some schools fall below the standard. The shortages appear most pronounced in junior colleges. This was to be expected, since traditionally less space was allocated to both junior college administrators and teachers. Many of them had lower expectations with respect to office facilities, having previously taught in high schools, where faculty offices are minimal. Our site visits have indicated that expectations for office space are escalating, and that faculties in junior colleges are demanding, and getting, more generous office space allocations.

In other categories, the findings about space are more equivocal. In this section, the estimates of space are based on average staff/student ratios, and one would expect less space in some larger schools. Nevertheless, it is safe to conclude that public colleges have less space than is warranted by the standards. The case for shortages of office space is less convincing, even with these rough figures for other schools. Further analysis, based on more precise data below, will adduce more convincing evidence.

Study Space. While there appeared to be no critical shortages in any of the preceding categories, even aggregate statistics indicate shortages of study space in most institutions, except the very smallest ones. Percentage-wise, the largest shortfalls of space required to accommodate the average collection of books and provide the necessary space for students occurs in junior colleges. Only very small junior colleges appear to have sufficient or excess space. Less serious, but equally sharp shortages, when compared to the standard, are evident in public four-year institutions and public universities. Since the standards were derived on the basis of the average number of volumes in the collections of various types of institutions, even if one were to ignore variations in the number of volumes per full-time-equivalent student, it is obvious that study space for students in libraries is less than most experts consider adequate.

Special Use Space. The conclusions about special use space are less easy to draw. Table 5.1 shows that there is less special use space per full-time-equivalent student in larger schools, as compared to smaller schools. These amenities are least generously provided in two-year schools, as compared to other schools. Generally, public universities, probably because of their commitment to football, are most generously endowed with this space. So are smaller private universities.

General Use Space. Most smaller schools have their full quota of general use space. Larger schools have less. It is not possible to determine from aggregative figures whether we are seeing an example of economies of scale or just different building patterns.

Support Space. A perusal of forms, institution by institution, reveals that this space is reported most inaccurately. Many institutions report this space together with other space. Given the standards derived from schools which have supplied the reports, and space available in schools which have provided statistics on support space, one can conclude either that economies of scale operate, or that large schools are somewhat shorter of support space than smaller ones.

Analysis of Available Space Based on Rankings by Total Non-Residential Space

A refrain which should have accompanied the analysis of space, category by category, is that the conclusions are tentative, since much space is interchangeable, and the demand for space in a given institution is affected by the character of its program. We will defer measures of the character of the program on the demand for space until the next chapter. In the section below, we shall analyze the distribution of space within types of institutions, with institutions grouped into four categories after they were ranked by availability of total non-residential space.

After prolonged conversations with both state and individual campus planners, we became aware of a dichotomy between theory and practice in campus planning. It is not at all clear whether space should be planned per full-time or full-time-equivalent student, or ideally on the basis of full-time-equivalent day students, a statistic not collected nationally. Peak demands for campus facilities occur during the day, and a fairly accurate way of arriving at an estimate of full-time-equivalent daytime students is to use the figure of total full-time students. Hence, it appeared reasonable to present an analysis of available space in terms of full-time students as an approximation of one way of computing space. We became increasingly aware that, in some states, planning factors for public institutions were based on full-time-equivalent students, and that much of the available space was provided to accommodate FTE attendance figures.

An attempt to determine what actually happens in campus planning through statistical analysis did not turn out to be enlightening. We compared the standard deviations of different types of space on campuses ranked by total non-residential space by size of school within type, with space averages computed on the basis of full-time or full-time-equivalent students. The standard deviations of both total non-residential space and different categories of space did not differ significantly from each other in the case when the available space was calculated per full-time student, or if it was computed per full-time-equivalent student. In most cases, the standard deviations for individual types of space within a quartile were half the size of the mean, thus indicating a wide variety of space arrangements in different schools. (See Appendix Table 5.4)

A comparison of each individual type of space in institutions which have the same amount of space per student shows the wide range of space preferences among these institutions. For instance, one institution will have two or three times as much classroom space as another institution with the same amount of total space per student. These variations could be due to historical accident, differences in program emphasis or donor whims. It is also possible that these differences are more apparent than real since different types of space may be interchangeable. We do not take a position on this issue and analyze space under either assumption.

Range of Space Available by Quartile of Institution.

Ranges of space between the least-well-endowed quartile of a given type, control, and size of institution and the one most richly endowed with space vary between 20 and 200 per cent for classroom space between the average institutions, and more widely for institutions with specialized purposes. In the case of laboratory space, the variations are even wider, with some of the average institutions having 3.5 times as much space as others. Some specialty schools had even wider ranges. These ranges are documented in Table 5.3.

If this table proves anything, it is that institutions can get along with a wide range of space availability.

Range of Space by Size of Institution. It has been seen that, on the average, the larger the size of the institution, the less available space there is per full-time or full-time-equivalent student. We believed this proposition as firmly as the majority of authorities in the field of space planning when we started this study.

This belief that larger institutions *need* less space than smaller ones is considerably weakened by our analysis. Two facts contributed to this conclusion: (1) the space available in institutions in both the first and second quartiles did not differ significantly or systematically from one size group to another (see Appendix Tables 5.1 to 5.3); and (2) within the fairly wide size ranges encompassed within each quartile of institutions, grouped by type and control, there was little variation between the average enrollment of space-poor and space-rich institutions.

These findings contradict observations by space planners. For instance, one authority believes that large classrooms and auditoriums, necessary to accommodate introductory courses, are more difficult to schedule efficiently in schools with low enrollments, as contrasted to schools with more students. Also, in the space planning guide of the City University of New York, some allowance was made for additional non-academic facilities above average standards for small schools. This allowance makes sense, if these schools are to be provided with "one of each facility." For instance, a single swimming pool is sufficient for a wide range of student enrollments. Other athletic facilities also do not come in easily divisible quantities.

On the other hand, it can be argued that schools with small enrollments do not require the full range of non-academic facilities, and that multiple uses of space, especially for athletic facilities, can be attained with better planning and more adventurous use of modern technology. Some educators have argued that the advantages of small schools over large ones can offset the relative dearth of facilities. To this argument can be added the voice of economists, who have observed that the amount of fixed capital per unit of production should be equalized in an efficient society.

For the time being, in the following discussion we have ignored differences in size, as they affect space utilization. They will be re-introduced at a later time, when future space requirements will be discussed.

Analysis by Type, Control, and Size of School Ranked on Space Availability

The analysis which follows is more policy-relevant compared to the one based on average space by school. While average data provides an over-all impression of the adequacy of the space available, it fails to highlight shortages of space on certain campuses by averaging available space in space-poor with space-rich campuses. A somewhat better idea of the shortages and surpluses of space can be derived by looking at sub-groups of campuses, when the space-poor campuses are grouped together, and those with a lot of space are also grouped together. In effect, each size group for each type of school (two-year, four-year, and those offering doctorates), by control, was divided into four groups after the schools were ranked in ascending order of total space. For each group with at least 40 schools (10 per quartile), various statistics were computed, and are described below.

Total Space. While the modest space standards developed in Chapter 4 failed to highlight space shortages in most classes of schools, with the exception of larger public four-year schools and junior colleges, the distribution of schools ranked by quartile on total space shows that a considerable number of schools are not up to Chapter 4's standards. Thus, all schools in the lower quartile of their distribution make do with less space than the standards would postulate. In the larger public junior colleges, the facilities shortages extend to the second and sometimes the third quartile of the larger schools.

The discussion of space below will give an inkling about the way schools adjust to shortages of space. Thus, for instance, while practically every school in the lower quartile was short of space when total non-residential space standards were considered, most of them had sufficient space for classroom instruction, and skimped on other space.

Classroom Space. We shall start our discussion with an analysis of classroom space. For instance, in the smaller public junior colleges, those with less than 1,000 students, schools in the lowest quartile have roughly half the space as those in the top quartile. In other size groups, the ratio of space between schools in the low and high quartiles are between three and four to one. Thus, while aggregated data indicated no shortages of classroom space in junior colleges, the disaggregated data below would indicate that all junior colleges with enrollments over 2.5 thousand in the two lowest quartiles were somewhat short of classroom space. Surprisingly, it is quite likely that private universities with 10 to 20 thousand enrollment in the lowest quartile were also tight on classroom space, although not as tight as some junior colleges. Other schools appeared to be fairly well provided with classrooms.

Laboratory Space. In the case of laboratory space, less than the standard space required for the average program was either causing overcrowding or limiting the scope of the program. Private junior colleges generally have fewer science-oriented programs, and most of them have fewer labs than would be required in an "average" program. Public and private four-year colleges in the lowest quartile of space available also appear to be short of laboratory space. Strangely enough, so are the lowest quartile of public and private universities. Thus it could be concluded that shortages of space precluded heavy science-oriented programs.

Laboratory and Classroom Space Combined. It is, of course, quite possible that schools with less classroom space have more laboratory space, to compensate for a larger proportion of classes given in laboratories or vice versa. A combination of laboratory and classroom space, based on averages per FTE by quartile, indicate that some such compensation did occur. A more precise assessment of space, calculated on the basis of full-time students, indicates that shortages defined as fewer than 20 net square feet of assignable classroom and laboratory space per full-time student exist only in large public and private two-year schools.

Office Space. The situation with respect to office space highlights that roughly half of the schools have sufficient space, and half do not. While office space, on the average, is sufficient, it is certainly not distributed evenly between schools.

Study Space. Shortages of study space are considerably more pronounced. No large public two-year college appears to have sufficient study space, and neither do three-fourths of the smaller ones. Conditions similar to those in smaller junior colleges prevail in public and private four-year schools and public universities. About half of the plant in public universities is sufficient to provide for average facilities. Given that the standards have been derived on the basis of an average collection, it would appear that roughly 25 per cent of all schools with below-average collections have less than adequate space.

Special Use, General Use, and Support Space. Since so much of the special use and general use space is interchangeable, a separate analysis will not be attempted here. Those interested in the details of the distribution of this type of space are referred to the Appendix. A perusal of the Appendix tables will indicate that the variety of availability of space is great. So much depends on the amenities which the school wishes to provide that generalizations are difficult. The great variety in the practices explains why space planners have been reluctant to set standards for this type of space.

Table 5.4 details the findings with respect to classroom, laboratory, office, study, and total non-residential space. Shortages or the absence of shortages were defined as follows: (1) if the quartile mean less one standard deviation was still equal to the space standard, no shortage was noted in the table; (2) if the quartile mean less one standard deviation was less than the space standard, the entry reads, "some shortage;" (3) if the standard is greater than the mean and at least half of the schools were below the standard the entry reads, "shortage;" and (4) if the quartile mean plus three standard deviations is still below the standard, a "severe shortage" was diagnosed.

A comparison of the different entries in the table indicates that shortages were most pronounced in office and study space. Most schools were in much less dire straits with respect to classroom and laboratory space than their general condition with respect to total space would lead one to believe.

Incremental Increases of Space by Type, Control, and Size of College

The large variations of space by type which were highlighted in the analysis of different types of space, as well as in the analysis of the distribution of space in the exercise when schools were ranked by total non-residential space available, raised grave doubts about either the rationality of construction policies of different schools or the possibility of comparing space allocation, even between similar types of schools. Another attempt to uncover a pattern on decision-making in the acquisition of additional space was tried. The ratio of a given type of non-residential space to the total increment of non-residential space was calculated, comparing quartile 1 to quartile 2,

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quartile 2 to quartile 3, and quartile 3 to quartile 4 for a given type, control, and size of school. For instance, private universities in the second quartile had 51 square feet more non-residential space per full-time student than those in the first quartile. Roughly 23 per cent of that space was accounted for by class and lab space, 27 per cent by office space, 10 per cent by study space, and 40 per cent by other space. The patterns are shown in Appendix Table 5.6.

Regretfully, no clear-cut pattern can be found through those tables. Institutions add space in a different manner. Strangely enough, in most institutions, the patterns of space addition from the first to second and third to fourth quartiles are fairly similar, and those from the second to the third quartile are somewhat different from the other two. Hence, it is not possible to calculate the marginal propensity to add space under most conceivable circumstances.

Two complementary hypotheses may be advanced: (1) Schools add space over and above the minimum either to round off their campuses or to build facilities which did not exist before. The priorities by type of space are by no means clear-cut. These priorities are different for different kinds of schools. Schools with more space may decide that their program already meets the demands of their constituency, and that the first priority lies in the building of assembly halls, theaters, and libraries. (2) Once minimum needs are met, an over-all expansion of facilities across the board is undertaken.

These hypotheses have important implications for a national construction policy. If the needs for individual schools cannot be evaluated, the federal authorities may wish to take the position to insure that space available meets certain minimum standards and that specialized needs be financed either by non-federal authority or by agencies trying to encourage certain specific activities by institutions in certain chosen locations.

Residential Space

Residential space plays an important role in the stock of space owned by post-secondary institutions. In the Fall of 1971, for instance, residential space accounted for roughly 30 per cent of assignable space of all institutions. Unfortunately, the analysis of this type of space need cannot be too detailed. Space standards of adequate space for single and married students have been documented by various authorities, and they do not need to be repeated here. These space standards do not give any guidance as to how much space is required or desirable, either for any given sets of institutions, or for an institution itself. Institutions have varying policies with regard to dormitory and other residential space, with public two-year schools providing the least space per student, and private two- and four-year schools providing the most. There are also important variations in space provided per enrolled student, depending upon the location of the campus. Central city campuses are least well provided with residential space, campuses in other metropolitan locations are somewhat better served, and those in non-metropolitan areas have the most space per student enrolled (see Table 5.5)

While these figures illustrate the distribution of residential space during the recent past, they are not extremely helpful in foretelling how much space will be required in the future. In 1957, for instance, there were some 78 million assignable square feet of residential space. In other words, there were 25 square feet of residential space per student. By 1968, there were 282 million net assignable square feet per total students, or 37.5 square feet per student. By 1971, the total was 368 million square feet, or 41 square feet for every student enrolled.

During the intervening period, enrollment patterns had changed considerably. A larger proportion of students was enrolled in two-year schools and public institutions. Since we are extremely badly served by data on past patterns of enrollments, only the crudest comparison can be made of the effect of these shifts (see Table 5.6). This table shows the index of space available per enrolled student, using Fall 1971 as 100 in the first column. Another index of space availability has been calculated by taking into account the space per enrolled student in 1971 and enrollments in 1957 and 1968. The ratio of the expected space available in those years was then divided by the actual space to produce another index which reflects shifts in enrollment.

The new weighted index, which does not take into account the lessened propensity of graduate students, low-income students, and other groups recently attracted to our universities to live in institutional settings, shows that residential space is much more generously provided now than, say, fifteen or even four years ago.

There are strong indications that a general overall equilibrium has been reached in the supply of residential space. While vacancies were few in the middle 1960's, the occupancy rate in the late 1960's and early 1970's dropped to some 95 per cent. As of 1972, there were indications that occupancy rates (at least in larger institutions in the Northeast) had picked up, and "no vacancy" signs were up again. In the Western and some Southwestern states, there will still reports of underutilization of dormitories.

The changing mores of students have been blamed for the plateauing of demand for dormitory spaces. Despite relaxation of parietal rules in the late 1960's, the stampede for dormitory rooms did not occur, and the explanation must be sought elsewhere.

Despite the fact that at least 90 per cent of all dormitories has been built in the past 30 years, and 75 per cent in the past 15 years alone, many residential facility buildings offer Spartan space in unattractive surroundings. Builders failed to take into account the increase in the general standard of living in the United States and the concomitant improvement in non-institutional housing standards. Dark corridors, shared bathrooms, and box-like rooms did nothing to endear institutional residential housing to students.

The crisis in residential occupancy was also precipitated by the unfavorable relationship of prices for residential accommodations compared to average rental prices in the United States. During the mid-1960's, prices charged by institutions rose faster than average prices for rental units. Hence, it became harder and harder to fill dormitories.

In the recent past, as the rate of new, expensive dormitories coming on line slowed down, price increases by schools moderated as well, and there are indications that dorms are filling up again. If institutions price their dormitories at levels which are competitive with other alternatives, there is little reason to believe that another 15 to 25 per cent increase in enrollment cannot be accommodated with present dormitory facilities.

There may, perhaps, be regional or campus-by-campus shortages. Also, schools may wish to build subsidized housing to attract students from other schools of equal quality. On the whole, though, dormitory shortages are not likely to put a crimp on enrollment growth, if such growth does materialize.

TABLE 5.1

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Class Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Public Universities (Standard: 9.0)	Over 20,000	22	9.40 (1.97)
	10,000 to 20,000	58	10.55 (2.58)
	Less than 10,000	49	13.55 (5.24)
Private Universities (Standard: 8.7)	Over 20,000	3	8.94 (3.50)
	10,000 to 20,000	10	14.65 (3.14)
	Less than 10,000	68	9.62 (1.17)
Public Four-Year Schools (Standard: 8.8)	Over 10,000	20	8.62 (2.81)
	5,000 to 10,000	72	11.19 (3.97)
	2,500 to 5,000	94	14.26 (6.78)
	Less than 2,500	122	20.16 (12.81)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Class Space, Square Feet per FTE (Cont'd)

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Private Four-Year Schools (Standard: 9.1)	Over 5,000	7	12.73 (3.76)
	2,500 to 5,000	46	14.62 (4.58)
	1,000 to 2,500	282	21.16 (9.30)
	Less than 1,000	515	30.82 (22.64)
Public Two-Year Schools (Standard: 7.6)	Over 5,000	55	8.67 (5.98)
	2,500 to 5,000	113	9.71 (4.34)
	1,000 to 2,500	218	13.42 (7.43)
	Less than 1,000	304	28.91 (68.85)
Private Two-Year Schools (Standard: 9.3)	1,000 to 2,500	12	14.65 (5.20)
	Less than 1,000	194	38.36 (37.63)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Lab* Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Public Universities (Standard: 6.7)	Over 20,000	22	14.40 (4.73)
	10,000 to 20,000	58	16.11 (6.06)
	Less than 10,000	49	19.64 (5.24)
Private Universities (Standard: 6.5)	Over 20,000	3	9.59 (4.11)
	10,000 to 20,000	10	13.39 (5.27)
	Less than 10,000	66	17.41 (10.52)
Public Four-Year Schools (Standard: 6.6)	Over 10,000	20	12.30 (3.88)
	5,000 to 10,000	72	13.31 (5.70)
	2,500 to 5,000	94	14.78 (6.85)
	Less than 2,500	116	19.91 (14.30)

* Excluding labs used for research only.

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Lab* Space, Square Feet per FTE (Cont'd)

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Private Four-Year Schools (Standard: 6.8)	Over 5,000	7	8.67 (3.94)
	2,500 to 5,000	45	14.01 (8.38)
	1,000 to 2,500	280	20.11 (11.14)
	Less than 1,000	480	24.72 (17.50)
Public Two-Year Schools (Standard: 5.7)	Over 5,000	55	13.90 (7.15)
	2,500 to 5,000	113	14.82 (8.97)
	1,000 to 2,500	217	18.42 (12.40)
	Less than 1,000	298	27.92 (28.81)
Private Two-Year Schools (Standard: 7.0)	1,000 to 2,500	12	8.63 (5.26)
	Less than 1,000	194	38.36 (37.63)

* Excluding labs used for research only.

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Class and Lab* Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Public Universities (Standard: 15.7)	Over 20,000	22	23.80 (5.59)
	10,000 to 20,000	58	26.66 (7.19)
	Less than 10,000	49	33.18 (12.89)
Private Universities (Standard: 15.2)	Over 20,000	3	18.53 (6.74)
	10,000 to 20,000	10	28.04 (7.29)
	Less than 10,000	68	36.22 (14.68)
Public Four-Year Schools (Standard: 15.4)	Over 10,000	20	20.92 (4.64)
	5,000 to 10,000	72	24.50 (8.02)
	2,500 to 5,000	94	29.04 (10.90)
	Less than 2,500	122	39.10 (22.62)

* Excluding labs used for research only.

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Class and Lab* Space, Square Feet per FTE (Cont'd)

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Private Four-Year Schools (Standard: 15.9)	Over 5,000	7	21.40 (6.28)
	2,500 to 5,000	46	28.32 (11.87)
	1,000 to 2,500	282	41.13 (17.33)
	Less than 1,000	516	53.76 (31.17)
Public Two-Year Schools (Standard: 13.3)	Over 5,000	55	22.58 (10.61)
	2,500 to 5,000	113	24.53 (11.59)
	1,000 to 2,500	218	31.75 (16.35)
	Less than 1,000	304	56.28 (88.98)
Private Two-Year Schools (Standard: 16.3)	1,000 to 2,500	12	23.28 (9.39)
	Less than 1,000	194	59.36 (51.39)

* Excluding labs used for research only.

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Office Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Public Universities (Standard: 18.0)	Over 20,000	22	28.74 (10.37)
	10,000 to 20,000	58	24.03 (7.99)
	Less than 10,000	49	26.37 (14.47)
Private Universities (Standard: 24.0)	Over 20,000	3	17.76 (5.68)
	10,000 to 20,000	10	36.21 (18.44)
	Less than 10,000	69	36.13 (26.84)
Public Four-Year Schools (Standard: 11.0)	Over 10,000	20	12.12 (3.29)
	5,000 to 10,000	72	13.29 (4.40)
	2,500 to 5,000	94	14.44 (5.03)
	Less than 2,500	122	20.74 (26.28)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Office Space, Square Feet per FTE (Cont'd)

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Private Four-Year Schools (Standard: 15.9)	Over 5,000	7	13.29 (3.93)
	2,500 to 5,000	46	16.39 (6.89)
	1,000 to 2,500	282	21.58 (8.79)
	Less than 1,000	516	24.97 (14.05)
Public Two-Year Schools (Standard: 9.4)	Over 5,000	55	6.65 (2.65)
	2,500 to 5,000	113	7.43 (2.86)
	1,000 to 2,500	218	9.24 (3.93)
	Less than 1,000	302	12.24 (7.26)
Private Two-Year Schools (Standard: 15.8)	1,000 to 2,500	12	9.76 (5.14)
	Less than 1,000	193	25.14 (26.75)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Study Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Public Universities (Standard: 13.6)	Over 20,000	22	10.45 (4.50)
	10,000 to 20,000	58	9.92 (3.77)
	Less than 10,000	48	11.71 (5.76)
Private Universities (Standard: 21.1)	Over 20,000	3	6.57 (3.78)
	10,000 to 20,000	10	23.39 (11.76)
	Less than 10,000	69	21.94 (17.38)
Public Four-Year Schools (Standard: 11.2)	Over 10,000	20	6.31 (3.03)
	5,000 to 10,000	72	7.44 (3.39)
	2,500 to 5,000	94	9.41 (4.35)
	Less than 2,500	119	13.92 (12.70)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Study Space, Square Feet per FTE (Cont'd)

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Private Four-Year Schools (Standard: 16.3)	Over 5,000	7	8.11 (4.96)
	2,500 to 5,000	46	12.11 (6.79)
	1,000 to 2,500	282	16.68 (10.37)
	Less than 1,000	512	24.19 (21.88)
Public Two-Year Schools (Standard: 9.0)	Over 5,000	55	3.55 (1.66)
	2,500 to 5,000	111	4.51 (2.69)
	1,000 to 2,500	217	6.05 (4.55)
	Less than 1,000	287	10.85 (8.29)
Private Two-Year Schools (Standard: 11.7)	1,000 to 2,500	12	8.63 (5.46)
	Less than 1,000	190	23.93 (39.63)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

General Use Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Public Universities (Standard: 14.9)	Over 20,000	22	13.22 (7.00)
	10,000 to 20,000	58	14.24 (6.23)
	Less than 10,000	48	19.76 (10.39)
Private Universities (Standard: 25.5)	Over 20,000	3	8.11 (3.95)
	10,000 to 20,000	10	19.73 (10.10)
	Less than 10,000	68	32.30 (26.94)
Public Four-Year Schools (Standard: 14.6)	Over 10,000	20	6.45 (5.14)
	5,000 to 10,000	72	14.08 (6.03)
	2,500 to 5,000	93	17.76 (8.94)
	Less than 2,500	116	26.35 (25.29)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

General Use Space, Square Feet per FTE (Cont'd)

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Private Four-Year Schools (Standard: 37.7)	Over 5,000	7	13.13 (7.47)
	2,500 to 5,000	46	23.34 (14.62)
	1,000 to 2,500	281	37.67 (21.31)
	Less than 1,000	512	57.10 (60.97)
Public Two-Year Schools (Standard: 7.8)	Over 5,000	55	5.61 (2.70)
	2,500 to 5,000	113	6.97 (4.43)
	1,000 to 2,500	217	9.08 (7.66)
	Less than 1,000	282	13.78 (12.35)
Private Two-Year Schools (Standard: 35.2)	1,000 to 2,500	12	18.66 (15.87)
	Less than 1,000	191	62.59 (81.07)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Special Use Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Public Universities (Standard: 15.2)	Over 20,000	22	13.75 (8.38)
	10,000 to 20,000	58	14.89 (10.31)
	Less than 10,000	47	18.87 (13.96)
Private Universities (Standard: 16.0)	Over 20,000	3	8.13 (7.99)
	10,000 to 20,000	10	11.59 (5.57)
	Less than 10,000	65	19.83 (15.92)
Public Four-Year Schools (Standard: 13.1)	Over 10,000	20	7.03 (4.54)
	5,000 to 10,000	72	13.98 (8.59)
	2,500 to 5,000	91	14.52 (10.06)
	Less than 2,500	109	21.03 (22.84)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Special Use Space, Square Feet per FTE (Cont'd)

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Private Four-Year Schools (Standard: 20.6)	Over 5,000	7	6.28 (2.89)
	2,500 to 5,000	46	13.65 (10.64)
	1,000 to 2,500	277	21.76 (15.69)
	Less than 1,000	449	27.65 (30.56)
Public Two-Year Schools (Standard: 8.7)	Over 5,000	55	5.78 (2.67)
	2,500 to 5,000	110	6.97 (4.23)
	1,000 to 2,500	190	9.73 (8.83)
	Less than 1,000	213	20.21 (21.78)
Private Two-Year Schools (Standard: 25.9)	1,000 to 2,500	9	11.77 (7.18)
	Less than 1,000	154	55.65 (89.80)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Support Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Public Universities (Standard: 12.4)	Over 20,000	22	13.36 (9.77)
	10,000 to 20,000	58	12.18 (8.46)
	Less than 10,000	47	11.01 (5.49)
Private Universities (Standard: 16.1)	Over 20,000	3	8.61 (5.22)
	10,000 to 20,000	10	16.96 (14.20)
	Less than 10,000	65	19.83 (15.92)
Public Four-Year Schools (Standard: 6.4)	Over 10,000	20	5.55 (3.66)
	5,000 to 10,000	72	5.68 (4.06)
	2,500 to 5,000	94	7.08 (5.06)
	Less than 2,500	117	10.81 (15.57)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Support Space, Square Feet per FTE (Cont'd)

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Private Four-Year Schools (Standard: 13.4)	Over 5,000	7	5.74 (2.41)
	2,500 to 5,000	46	7.43 (7.11)
	1,000 to 2,500	279	14.03 (13.76)
	Less than 1,000	475	19.53 (24.06)
Public Two-Year Schools (Standard: 3.5)	Over 5,000	55	3.00 (3.53)
	2,500 to 5,000	108	2.62 (2.18)
	1,000 to 2,500	196	4.69 (7.47)
	Less than 1,000	217	5.86 (9.32)
Private Two-Year Schools (Standard: 13.5)	1,000 to 2,500	11	9.03 (6.87)
	Less than 1,000	156	30.33 (64.53)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Total Non-Residential Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Public Universities (Standard: 89.8)	Over 20,000	22	124.48 (45.87)
	10,000 to 20,000	58	114.21 (39.15)
	Less than 10,000	49	131.65 (46.59)
Private Universities (Standard: 117.9)	Over 20,000	3	73.12 (23.62)
	10,000 to 20,000	10	161.40 (69.23)
	Less than 10,000	69	181.13 (129.34)
Public Four-Year Schools (Standard: 71.7)	Over 10,000	20	59.51 (15.24)
	5,000 to 10,000	72	80.03 (24.88)
	2,500 to 5,000	94	92.56 (31.98)
	Less than 2,500	122	129.82 (104.89)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Total Non-Residential Space, Square Feet per FTE (Cont'd)

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Private Four-Year Schools (Standard: 119.8)	Over 5,000	7	69.18 (15.76)
	2,500 to 5,000	46	103.04 (48.94)
	1,000 to 2,500	282	153.77 (67.36)
	Less than 1,000	516	202.63 (126.63)
Public Two-Year Schools (Standard: 51.7)	Over 5,000	55	47.20 (17.25)
	2,500 to 5,000	113	52.72 (21.86)
	1,000 to 2,500	218	68.87 (35.63)
	Less than 1,000	305	109.58 (100.46)
Private Two-Year Schools (Standard: 118.4)	1,000 to 2,500	12	77.44 (43.21)
	Less than 1,000	194	238.42 (253.66)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Residential Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Public Universities	Over 20,000	22	51.45 (30.34)
	10,000 to 20,000	55	60.11 (28.64)
	Less than 10,000	44	75.30 (37.37)
Private Universities	Over 20,000	3	37.71 (19.01)
	10,000 to 20,000	10	68.31 (48.27)
	Less than 10,000	67	94.02 (80.51)
Public Four-Year Schools	Over 10,000	16	32.67 (36.81)
	5,000 to 10,000	66	54.51 (33.34)
	2,500 to 5,000	78	65.06 (36.79)
	Less than 2,500	91	84.70 (67.32)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Residential Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Private Four-Year Schools	Over 5,000	7	43.82 (17.19)
	2,500 to 5,000	43	67.20 (47.75)
	1,000 to 2,500	271	108.43 (60.92)
	Less than 1,000	465	140.32 (92.35)
Public Two-Year Schools	Over 5,000	4	1.32 (0.95)
	2,500 to 5,000	12	14.93 (20.91)
	1,000 to 2,500	64	27.91 (32.28)
	Less than 1,000	78	61.79 (88.89)
Private Two-Year Schools	1,000 to 2,500	10	81.77 (76.75)
	Less than 1,000	162	168.99 (147.74)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Medical Care Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Public Universities	Over 20,000	12	3.88 (3.89)
	10,000 to 20,000	20	1.12 (1.59)
	Less than 10,000	12	1.38 (2.08)
Private Universities	10,000 to 20,000	7	2.15 (1.21)
	Less than 10,000	10	1.78 (1.98)
Public Four-Year Schools	5,000 to 10,000	9	0.10 (0.10)
	2,500 to 5,000	11	0.47 (0.37)
	Less than 2,500	8	1.48 (2.78)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Medical Care Space, Square Feet per FTE (Cont'd)

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Private Four-Year Schools	Over 5,000	3	1.64 (2.07)
	2,500 to 5,000	4	0.58 (0.50)
	1,000 to 2,500	25	1.58 (1.84)
	Less than 1,000	42	1.66 (1.42)
Public Two-Year Schools	2,500 to 5,000	6	0.47 (0.32)
	1,000 to 2,500	5	0.31 (0.17)
	Less than 1,000	7	1.86 (1.43)
Private Two-Year Schools	Less than 1,000	7	2.81 (1.67)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS HEGIS V, 1970-71

Laboratory Research Space, Square Feet per FTE

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Public Universities	Over 20,000	22	19.05 (12.51)
	10,000 to 20,000	58	11.90 (11.06)
	Less than 10,000	48	12.53 (12.35)
Private Universities	Over 20,000	3	5.41 (0.48)
	10,000 to 20,000	10	23.98 (16.77)
	Less than 10,000	62	21.38 (63.66)
Public Four-Year Schools	Over 10,000	20	1.13 (0.79)
	5,000 to 10,000	63	1.21 (1.29)
	2,500 to 5,000	74	1.41 (0.16)
	Less than 2,500	69	3.71 (17.47)

TABLE 5.1 (Cont'd)

MEAN AND STANDARD DEVIATION FOR SELECTED TYPES OF FACILITIES BY TYPE, CONTROL, AND SIZE OF CAMPUS, HEGIS V, 1970-71

Laboratory Research Space, Square Feet per FTE (Cont'd)

	FTE Enrollment Category	Number of Institutions	Mean (Standard Deviation)
Private Four-Year Schools	Over 5,000	7	0.53 (0.30)
	2,500 to 5,000	37	2.18 (2.14)
	1,000 to 2,500	191	2.12 (2.93)
	Less than 1,000	182	3.01 (9.49)
Public Two-Year Schools	Over 5,000	9	0.14 (0.13)
	2,500 to 5,000	29	0.16 (0.20)
	1,000 to 2,500	37	0.64 (1.13)
	Less than 1,000	27	1.47 (1.73)
Private Two-Year Schools	Less than 1,000	18	3.40 (6.13)

Source: Special tabulations from HEGIS V.

TABLE 5.2

CLASS PLUS LAB* SPACE PER FTE STUDENT, WITH LAB* SPACE REDUCED TO 11 PER CENT EFFICIENCY

(Square Feet per FTE Student)

	Mean
Public Universities	
Less than 10,000	15.71
10,000 to 20,000	12.32
Over 20,000	10.98
Private Universities	
Less than 10,000	21.24
10,000 to 20,000	16.16
Public Other Four-Year Schools	
Less than 2,500	19.74
2,500 to 5,000	15.89
5,000 to 10,000	12.65
Over 10,000	9.97
Private Other Four-Year Schools	
Less than 1,000	30.07
1,000 to 2,500	23.37
2,500 to 5,000	16.16
Over 5,000	13.68
Public Two-Year Schools	
Less than 1,000	23.05
1,000 to 2,500	15.45
2,500 to 5,000	11.34
Over 5,000	10.20
Private Two-Year Schools	
Less than 1,000	31.08
1,000 to 2,500	15.60

*Excluding labs used for research only.

Source: See text, p. 96.

TABLE 5.3

RATIO OF HIGH TO LOW QUARTILE OF SPACE PER FT OR FTE STUDENT FOR SCHOOLS RANKED ON AVAILABLE SPACE, BY TYPE, CONTROL, AND SIZE OF INSTITUTION

A. Class Space per FT Student

Ratio	Type of Institution	Enrollment
Less than 2	Public Universities	Less than 10,000
	" "	10,000 to 20,000
	" "	Over 20,000
	Private Universities	10,000 to 20,000
	Public Four-Year Schools	2,500 to 5,000
	" "	5,000 to 10,000
	" "	10,000 to 20,000
	Private Four-Year Schools	Less than 1,000
	" "	1,000 to 2,500
	" "	2,500 to 5,000
	Public Two-Year Schools	2,500 to 5,000
	" "	Over 5,000
	Private Two-Year Schools	1,000 to 2,500
	Public Technical Schools	1,000 to 2,500
	Private Technical Schools	2,500 to 5,000
	Public Institutions with Medical Facilities	Over 5,000
	Private Institutions with Medical Facilities	Over 5,000
	Public Medical Schools	Less than 1,000
	Private Medical Schools	Less than 1,000

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TABLE 5.3 (Cont'd)

RATIO OF HIGH TO LOW QUARTILE OF SPACE PER FT OR FTE STUDENT FOR SCHOOLS RANKED ON AVAILABLE SPACE, BY TYPE, CONTROL, AND SIZE OF INSTITUTION

A. Class Space per FT Student (Cont'd)

Ratio	Type of Institution	Enrollment
2 to 3	Private Universities	Less than 10,000
	Public Two-Year Schools	Less than 1,000
	" "	1,000 to 2,500
	Private Two-Year Schools	Less than 1,000
	Private Fine Arts Schools	Less than 1,000
	Private Technical Schools	1,000 to 2,500
3 to 4	Public Technical Schools	Less than 1,000
4 to 5	Public Four-Year Schools	Less than 2,500

B. Lab* Space per FT Student

Ratio	Type of Institution	Enrollment
Less than 2	Public Universities	10,000 to 20,000
	" "	Over 20,000
	Private Universities	10,000 to 20,000
	Public Four-Year Schools	2,500 to 5,000
	" "	5,000 to 10,000
	" "	10,000 to 20,000
	Public Two-Year Schools	Over 5,000
	Public Institutions with Medical Facilities	More than 5,000

*Excluding labs used for research only.

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TABLE 5.3 (Cont'd)

RATIO OF HIGH TO LOW QUARTILE OF SPACE PER FT OR FTE STUDENT FOR SCHOOLS RANKED ON AVAILABLE SPACE, BY TYPE, CONTROL, AND SIZE OF INSTITUTION

B. Lab* Space per FT Student (Cont'd)

Ratio	Type of Institution	Enrollment
2 to 3	Public Universities	Less than 10,000
	Private Universities	Less than 10,000
	Public Four-Year Schools	Less than 2,500
	Private Four-Year Schools	1,000 to 2,500
	Private Two-Year Schools	1,000 to 2,500
	Private Technical Schools	2,500 to 5,000
	Private Medical Schools	Less than 1,000
3 to 4	Private Four-Year Schools	Less than 1,000
	'' ''	2,500 to 5,000
	Public Two-Year Schools	Less than 1,000
	'' ''	2,500 to 5,000
	Private Two-Year Schools	Less than 1,000
	Private Technical Schools	1,000 to 2,500
	Public Medical Schools	Less than 1,000
4 to 5	Public Two-Year Schools	1,000 to 2,500
More than 5	Private Fine Arts Schools	Less than 1,000
	Public Technical Schools	Less than 1,000
	'' ''	1,000 to 2,500
	Private Technical Schools	Less than 1,000

*Excluding labs used for research only.

TABLE 5.3 (Cont'd)

RATIO OF HIGH TO LOW QUARTILE OF SPACE PER FT OR FTE STUDENT FOR SCHOOLS RANKED ON AVAILABLE SPACE, BY TYPE, CONTROL, AND SIZE OF INSTITUTION

C. Study Space per FTE Student

Ratio	Type of Institution	Enrollment
Less than 2	Public Universities	Less than 10,000
	" "	10,000 to 20,000
	Public Four-Year Schools	5,000 to 10,000
	Public Two-Year Schools	Over 5,000
	Public Technical Schools	2,500 to 5,000
2 to 3	Public Universities	Over 20,000
	Public Four-Year Schools	Less than 2,500
	" "	2,500 to 5,000
	" "	10,000 to 20,000
	Private Four-Year Schools	Less than 1,000
	" "	1,000 to 2,500
	" "	2,500 to 5,000
	Public Two-Year Schools	Less than 1,000
	" "	2,500 to 5,000
	Public Institutions with Medical Facilities	More than 5,000
3 to 4	Private Universities	10,000 to 20,000
	Public Two-Year Schools	1,000 to 2,500
	Private Two-Year Schools	Less than 1,000
	" "	1,000 to 2,500
	Private Fine Arts Schools	Less than 1,000

TABLE 5.3 (Cont'd)

RATIO OF HIGH TO LOW QUARTILE OF SPACE PER FT OR FTE STUDENT FOR SCHOOLS RANKED ON AVAILABLE SPACE, BY TYPE, CONTROL, AND SIZE OF INSTITUTION

C. Study Space per FTE Student (Cont'd)

Ratio	Type of Institution	Enrollment
3 to 4	Public Technical Schools	1,000 to 2,500
	Private Technical Schools	2,500 to 5,000
4 to 5	Private Universities	Less than 10,000
	Public Technical Schools	Less than 1,000
	Private Medical Schools	Less than 1,000
More than 5	Private Technical Schools	Less than 1,000
	" "	1,000 to 2,500
	Private Institutions with Medical Facilities	More than 5,000
	Public Medical Schools	Less than 1,000

D. Total Non-Residential Space per FTE Student

Less than 2	Public Universities	Less than 10,000
	" "	10,000 to 20,000
	" "	Over 20,000
	Private Universities	Less than 10,000
	" "	10,000 to 20,000
	Public Four-Year Schools	Less than 2,500
	" "	2,500 to 5,000
	" "	5,000 to 10,000
	" "	10,000 to 20,000

TABLE 5.3 (Cont'd)

RATIO OF HIGH TO LOW QUARTILE OF SPACE PER FT OR FTE STUDENT FOR SCHOOLS RANKED ON AVAILABLE SPACE, BY TYPE, CONTROL, AND SIZE OF INSTITUTION

D. Total Non-Residential Space per FTE Student (Cont'd)

Ratio	Type of Institution	Enrollment
Less than 2	Private Four-Year Schools	Less than 1,000
	" "	1,000 to 2,500
	" "	2,500 to 5,000
	Public Two-Year Schools	2,500 to 5,000
	" "	Over 5,000
2 to 3	Public Two-Year Schools	Less than 1,000
	" "	1,000 to 2,500
	Private Two-Year Schools	Less than 1,000
	" "	1,000 to 2,500
	Public Institutions with Medical Facilities	More than 5,000
	Public Technical Schools	2,500 to 5,000
3 to 4	Public Technical Schools	1,000 to 2,500
4 to 5	Private Technical Schools	2,500 to 5,000
	Private institutions with Medical Facilities	More than 5,000
More than 5	Private Fine Arts Schools	Less than 1,000
	Public Technical Schools	Less than 1,000
	Private Technical Schools	Less than 1,000
	" "	1,000 to 2,500
	Public Medical Schools	Less than 1,000
	Private Medical Schools	Less than 1,000

TABLE 5.3 (Cont'd)

RATIO OF HIGH TO LOW QUARTILE OF SPACE PER FT OR FTE STUDENT FOR SCHOOLS RANKED ON AVAILABLE SPACE, BY TYPE, CONTROL, AND SIZE OF INSTITUTION

E. Office Space per Professional FTE

Ratio	Type of Institution	Enrollment
Less than 2	Public Four-Year Schools	10,000 to 20,000
2 to 3	Public Universities	Less than 10,000
	" "	10,000 to 20,000
	" "	Over 20,000
	Public Four-Year Schools	2,500 to 5,000
	" "	5,000 to 10,000
	Private Four-Year Schools	1,000 to 2,500
	Public Two-Year Schools	2,500 to 5,000
	" "	Over 5,000
3 to 4	Private Universities	10,000 to 20,000
	Public Four-Year Schools	Less than 2,500
	Private Four-Year Schools	Less than 1,000
	" "	2,500 to 5,000
	Public Two-Year Schools	Less than 1,000
4 to 5	Private Universities	Less than 10,000
	Public Two-Year Schools	1,000 to 2,500
	Private Two-Year Schools	Less than 1,000
	" "	1,000 to 2,500

Source: HEGIS V

TABLE 5.4

SHORTAGE AND ADEQUACY OF SPACE WITHIN QUARTILES BY TYPE, CONTROL, AND SIZE OF INSTITUTION

Public Universities

Enrollment	Space	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Less than 10,000	Class	Some Shortage	Some Shortage	No Shortage	No Shortage
	Lab*	Some Shortage	No Shortage	No Shortage	No Shortage
	Office	Some Shortage	No Shortage	No Shortage	No Shortage
	Study	Shortage	Shortage	Shortage	Some Shortage
	Total Non-Residential	Shortage	No Shortage	No Shortage	No Shortage
10,000 to 20,000	Class	Some Shortage	Some Shortage	Some Shortage	No Shortage
	Lab*	No Shortage	No Shortage	No Shortage	No Shortage
	Office	Some Shortage	No Shortage	Some Shortage	No Shortage
	Study	Shortage	Shortage	Shortage	Shortage
	Total Non-Residential	Shortage	Shortage	Shortage	Shortage
Over 20,000	Class	Shortage	Some Shortage	Some Shortage	Some Shortage
	Lab*	No Shortage	No Shortage	No Shortage	No Shortage
	Office	Some Shortage	No Shortage	No Shortage	No Shortage
	Study	**	**	**	**
	Total Non-Residential	**	**	**	**

* Excluding labs used for research only.
** Insufficient number of schools in quartile.

TABLE 5.4 (Cont'd)

SHORTAGE AND ADEQUACY OF SPACE WITHIN QUARTILES
BY TYPE, CONTROL, AND SIZE OF INSTITUTION

Private Universities

Enrollment	Space	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Less than 10,000	Class	No Shortage	No Shortage	No Shortage	Some Shortage
	Lab*	Some Shortage	No Shortage	No Shortage	No Shortage
	Office	Some Shortage	Some Shortage	Some Shortage	No Shortage
	Study	Shortage	Shortage	Some Shortage	Some Shortage
	Total Non-Residential	Shortage	Some Shortage	No Shortage	No Shortage
10,000 to 20,000	Class	Some Shortage	No Shortage	No Shortage	No Shortage
	Lab*	Some Shortage	No Shortage	No Shortage	No Shortage
	Office	Shortage	Some Shortage	No Shortage	Some Shortage
	Study	Severe Shortage	Severe Shortage	Some Shortage	Some Shortage
	Total Non-Residential	Severe Shortage	Some Shortage	No Shortage	No Shortage

* Excluding labs used for research only.

TABLE 5.4 (Cont'd)

SHORTAGE AND ADEQUACY OF SPACE WITHIN QUARTILES BY TYPE, CONTROL, AND SIZE OF INSTITUTION

Public Four-Year Schools

Enrollment	Space	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Less than 2,500	Class	Some Shortage	No Shortage	No Shortage	Some Shortage
	Lab*	Some Shortage	No Shortage	No Shortage	No Shortage
	Office	Shortage	Some Shortage	Some Shortage	No Shortage
	Study	Shortage	Some Shortage	Some Shortage	Some Shortage
	Total Non-Residential	Shortage	No Shortage	No Shortage	No Shortage
2,500 to 5,000	Class	Some Shortage	Some Shortage	No Shortage	No Shortage
	Lab*	Some Shortage	No Shortage	No Shortage	No Shortage
	Office	Shortage	Some Shortage	No Shortage	No Shortage
	Study	Shortage	Shortage	Shortage	Some Shortage
	Total Non-Residential	Shortage	No Shortage	No Shortage	No Shortage
5,000 to 10,000	Class	Shortage	Some Shortage	Some Shortage	No Shortage
	Lab*	Some Shortage	No Shortage	No Shortage	No Shortage
	Office	Shortage	Some Shortage	No Shortage	No Shortage
	Study	Shortage	Shortage	Shortage	Shortage
	Total Non-Residential	Shortage	Some Shortage	No Shortage	No Shortage

TABLE 5.4 (Cont'd)

SHORTAGE AND ADEQUACY OF SPACE WITHIN QUARTILES BY TYPE, CONTROL, AND SIZE OF INSTITUTION

Public Four-Year Schools (Cont'd)

Enrollment	Space	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
10,000 to 20,000	Class	Severe Shortage	Shortage	Some Shortage	Some Shortage
	Lab*	No Shortage	Some Shortage	No Shortage	No Shortage
	Office	Shortage	Some Shortage	Some Shortage	No Shortage
	Study	**	**	**	**
	Total Non-Residential	**	**	**	No Shortage

* Excluding labs used for research only.
** Insufficient number of schools in quartile.

TABLE 5.4 (Cont'd)

SHORTAGE AND ADEQUACY OF SPACE WITHIN QUARTILES BY TYPE, CONTROL, AND SIZE OF INSTITUTION

Private Four-Year Schools

Enrollment	Space	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Less than 1,000	Class	Some Shortage	No Shortage	No Shortage	No Shortage
	Lab*	Some Shortage	No Shortage	No Shortage	No Shortage
	Office	Shortage	Some Shortage	Some Shortage	No Shortage
	Study	Shortage	Some Shortage	Some Shortage	Some Shortage
	Total Non-Residential	Shortage	No Shortage	No Shortage	No Shortage
1,000 to 2,500	Class	No Shortage	No Shortage	No Shortage	No Shortage
	Lab*	Some Shortage	No Shortage	No Shortage	No Shortage
	Office	Some Shortage	Some Shortage	No Shortage	No Shortage
	Study	Shortage	Shortage	Some Shortage	Some Shortage
	Total Non-Residential	Shortage	No Shortage	No Shortage	No Shortage
2,500 to 5,000	Class	Some Shortage	No Shortage	No Shortage	No Shortage
	Lab*	Some Shortage	Some Shortage	No Shortage	No Shortage
	Office	Shortage	Some Shortage	Some Shortage	No Shortage
	Study	Severe Shortage	Shortage	Shortage	Some Shortage
	Total Non-Residential	Severe Shortage	Severe Shortage	Shortage	No Shortage

* Excluding labs used for research only.

TABLE 5.4 (Cont'd)

SHORTAGE AND ADEQUACY OF SPACE WITHIN QUARTILES
BY TYPE, CONTROL, AND SIZE OF INSTITUTION

Public Two-Year Schools

Enrollment	Space	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Less than 1,000	Class	Some Shortage	No Shortage	No Shortage	Some Shortage
	Lab*	Some Shortage	No Shortage	No Shortage	No Shortage
	Office	Shortage	Shortage	Some Shortage	Some Shortage
	Study	Shortage	Shortage	Some Shortage	Some Shortage
	Total Non-Residential	Shortage	No Shortage	No Shortage	No Shortage
1,000 to 2,500	Class	Shortage	Some Shortage	Some Shortage	Some Shortage
	Lab*	Some Shortage	No Shortage	No Shortage	No Shortage
	Office	Shortage	Shortage	Shortage	Some Shortage
	Study	Severe Shortage	Shortage	Shortage	Some Shortage
	Total Non-Residential	Severe Shortage	Some Shortage	No Shortage	No Shortage
2,500 to 5,000	Class	Shortage	Some Shortage	Some Shortage	No Shortage
	Lab*	Some Shortage	No Shortage	No Shortage	No Shortage
	Office	Shortage	Shortage	Shortage	Shortage
	Study	Severe Shortage	Shortage	Shortage	Shortage
	Total Non-Residential	Severe Shortage	Shortage	No Shortage	No Shortage

TABLE 5.4 (Cont'd)

SHORTAGE AND ADEQUACY OF SPACE WITHIN QUARTILES BY TYPE, CONTROL, AND SIZE OF INSTITUTION

Public Two-Year Schools (Cont'd)

Enrollment	Space	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Over 5,000	Class	Some Shortage	Shortage	Shortage	No Shortage
	Lab*	No Shortage	No Shortage	No Shortage	No Shortage
	Office	Shortage	Shortage	Shortage	Some Shortage
	Study	Severe Shortage	Severe Shortage	Severe Shortage	Shortage
	Total Non-Residential	Severe Shortage	Severe Shortage	Shortage	Some Shortage

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* Excluding labs used for research only.

TABLE 5.4 (Cont'd)

SHORTAGE AND ADEQUACY OF SPACE WITHIN QUARTILES BY TYPE, CONTROL, AND SIZE OF INSTITUTION

Private Two-Year Schools

Enrollment	Space	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Less than 1,000	Class	No Shortage	No Shortage	No Shortage	No Shortage
	Lab*	Some Shortage	Some Shortage	No Shortage	No Shortage
	Office	Shortage	Some Shortage	Some Shortage	Some Shortage
	Study	Shortage	Some Shortage	Some Shortage	Some Shortage
	Total Non-Residential	Shortage	Some Shortage	No Shortage	No Shortage
1,000 to 2,500	Class	Some Shortage	No Shortage	Some Shortage	No Shortage
	Lab*	Shortage	Shortage	Some Shortage	No Shortage
	Office	Shortage	Severe Shortage	Shortage	No Shortage
	Study	Severe Shortage	Severe Shortage	No Shortage	Some Shortage
	Total Non-Residential	Severe Shortage	Severe Shortage	Shortage	Some Shortage

* Excluding labs used for research only.

TABLE 5.4 (Cont'd)

SHORTAGES AND ADEQUACIES OF SPACE WITHIN QUARTILES
BY TYPE, CONTROL, AND SIZE OF INSTITUTION

If the quartile mean less one standard deviation is greater than the standard:	No shortage.
If the quartile mean less one standard deviation is less than the standard:	Some shortage.
If the quartile mean is less than the standard, but the quartile mean plus three standard deviations is greater than the standard:	Shortage (at least one-half of schools below mean)
If the quartile mean plus three standard deviations is less than the standard:	Severe shortage (all schools below mean)

Note: The standards are reproduced in Table 5.1.

TABLE 5.5

RESIDENTIAL SPACE PER FTE STUDENT ENROLLED, FALL 1970

	Universities		Other Four-Year Schools		Two-Year Schools	
	Public	Private	Public	Private	Public	Private
Central City	59	77	29	89	5	96
Other Metropolitan Area	63	109	55	127	4	180
Non-Metropolitan Area	78	161	77	134	46	203
Total	59	83	55	114	16	160

Source: HEGIS V, Special Analysis.

TABLE 5.6

INDEX OF AVAILABLE RESIDENTIAL SPACE PER STUDENT

(1971 = 100)

	Unweighted	Weighted
1957	61	30
1968	91	82
1971	100	100

Source: U. S. Department of Health, Education, and Welfare, Office of Education, *Inventory of Physical Facilities in Institutions of Higher Education: 1957, Fall 1968,* Table 9, p. 21. Also *Fall 1971*, Table 3, p. 10. Enrollment, U.S. DHEW, OE, *Projections of Educational Statistics,* and unpublished tabulations.

CHAPTER SIX

STATISTICAL DETERMINATION OF SPACE STANDARDS

Available space per full-time-equivalent student varies from campus to campus. There are also wide differences between the actual space available and the level recommended by space planning experts. If the space planning authorities were not influential in determining available space inventories, could it be possible that there was an unstated consensus among post-secondary education administrators which had not been enunciated up to now?

We attempted to find out whether such consensus existed by conducting an elaborate analysis of the availability of non-residential space. A series of regression equations were constructed to explain the stock of non-residential space as a function of enrollments, expenditures, staffing patterns and the orientation of the school measured by the number, level and types of degree granted. We hoped that the results of these regression equations would contribute to objective standards which explained how space was utilized.

Description of Data

The data base for these regressions consisted of various data elements from the HEGIS surveys for the school year 1970/1971. The various surveys collected information on facilities, by type, enrollments by level, and full-time or part-time status, staff, by type, and level, finances, and degrees granted by level and field of study. The institutions which reported all items of data accounted for an estimated 92.5 per cent of the full-time equivalent enrollment for that year, and can be considered as representative of the total number of institutions. In order to maximize the coverage, a number of responses had to be consolidated because a number of institutions with multiple campuses did not, or could not, provide the data for individual campuses, but aggregated certain types of data on a system-wide basis. In some instances, notably the State University of New York, data was reported both on a campus and system-wide basis requiring great care in editing the data from the various surveys.

The detail of the data elements, the types and size of institutions and the results of a large number of regression analysis appear in Appendix 6. This appendix also contains a detailed explanation of the methodology used, and the programs used. A summary of the results of the statistical analysis is given below.

Summary of Results

The analysis of statistical determinants of total non-residential space confirmed the impression gained through the less sophisticated analysis of data that there is a great deal of variability in available space in post-secondary education. For a number of institutional types, the objective criteria which are generally used to plan for space did not explain a large enough share of the variability to satisfy us. Apparently, other factors of a more subjective manner were responsible for the amount of space available. To some extent, the analysis was complicated by the presence of co-linearity of factors used to forecast space, e.g., those schools with high faculty/student ratios were also big spenders. Other circumstances, such as the recent or anticipated growth of enrollments, as in the case of public two-year schools, had resulted in the co-existence of schools with too little space or too many students, many of them in the process of building additional facilities, and others, with too much space and too few students, at the threshold of enrollment drives.

The "best" predictive equations, and their respective R^2, are reproduced in Table 6.1. Two comments are appropriate in this connection. In those cases where equations have only a few explanatory variables for the total non-residential space, as a general rule the co-linearity between variables was quite high, and it can be concluded that the factor proportions of these types of institutions were fairly alike. Also, whenever the R^2 are low, it can be concluded that the variability in space per student was quite high, despite the apparent homogeneity of the other factors. Space availability is apparently determined by different considerations than the allocation of current resources.

Analysis of Results

A set of limited conclusions can be drawn from the statistical analysis.

1. As a general rule, the amount of available space is determined not only by the number of students who attend the institution, but also by the number of persons employed on the staff, and the resources expended on instruction by the institution. With the exception of universities, defined in this study as institutions which grant doctorate degrees, the course mix did not seem to affect drastically the demand for space.

2. In universities, emphasis on doctoral programs in the physical sciences appeared to increase space demands considerably. Evaluated at the mean values, for small public universities, the enrollment term accounts for roughly 50 per cent of the space, the staff close to 25 per cent, and 23 per cent is derived from additional space demand represented by the program mix, in this case, represented by degrees granted. The constant term is not very important. For all private universities, the FTE enrollment, FTE staff, and instructional expenditure variables each contribute between 20 and 25 per cent of the total, and the degree variables contribute 22 per cent. The constant is responsible for the remaining eight per cent. In this last case, though, the demand for space due to course mix is difficult to interpret because two out of the six degree variables have a negative sign, and one is forced to conclude that more space than is indicated by the coefficients of other degrees is needed to house certain programs.

The program mix is much less important in other four-year schools, either public or private. In small public colleges, FTE enrollment is responsible for one-third of the demand for space, and instructional expenditures for over one-half of the total. The regression results for small private colleges are fairly similar: the instructional expenditure term explains 40 per cent of the demand for space, and the FTE enrollment term explains 24 per cent. In the case of these institutions, the constant term is much higher. As could be expected, the degree mix is also more important in explaining demand for space.

In large private colleges, despite the fact that the constant term accounts for a large 36 per cent of the total, FTE enrollment and FTE staff variables contribute 30 and 24 per cent, respectively, of the demand for space. The course mix seems to be much less important there.

It thus appears that the major influences on the amount of nonresidential space are FTE enrollment, FTE staff, and instructional expenditures. To a lesser degree, again depending upon the commitment to graduate programs, the course mix also appears to make a difference.

3. The rather consistent failure to obtain reasonable regression equations with the correct sign for both FTE staff and instructional expenditure variables needs some comment. Despite the fact that a

large number of schools with above-average space had both high staff ratios and high instructional expenditures per student, the co-linearity in staff and expenditures makes it difficult to capture this result in the regression equation. The fact that a negative sign sometimes appeared in front of the instructional expenditures variable can be plausibly explained. Institutions with more staff per student, and consequently lower work loads, as well as possibly more prestige, underpay their staff compared to institutions with high work loads and less prestige.

4. We have been highly selective in the presentation of results. Only a fraction of the regressions which were run are presented in this chapter or the appendix. We do believe that the results presented in this chapter and appendix are intuitively reasonable. For instance, the regression coefficient associated with FTE enrollment should exceed the mean classroom-plus-lab space in a given category, since additional space other than class and lab space is used by students. In most cases, and especially for the better regression equations, this was the case. Similarly, the regression coefficient for FTE staff should exceed the mean values of office space per FTE staff, since the staff requires some other types of space as well. This is corroborated by the regression equations.

5. Finally, an attempt was made to predict space requirements by using several of the better regression equations across the board--

i.e., for all institutional groups by type, control, and size. When these estimates were compared with the actual group means or reasonable space standards, the discrepancies were large and varied. The conclusion to be drawn from this is that the differences among the various groups of institutions are substantial enough that a regression equation for one institutional group cannot be expected to produce reliable estimates for other institutional groups.

Conclusions

The results which were obtained through the statistical analysis were not powerful enough to propose a new set of standards, but they can be used to model and validate standards derived in this study and presented in Table 4.7, and to model the response of institutions to changing conditions.

For instance, the staff to student ratio in small public universities is .274, and for small public colleges, it is .155. If all other things were equal, and public universities could make do with the same staff as four-year colleges, their space requirements could be reduced by 12 per cent.

In the case of private universities with a staff-to-student ratio of .346, a reduction in the staff-student ratio to .180, typical of private four-year schools, would result in a reduction of space requirements of 11 per cent. By comparison, if private universities were to have the same staff-student ratios as the small public ones (i.e., .274), one could expect a reduction in space requirements of roughly five per cent.

The reduction of space in public universities by 12 per cent, or roughly 10 square feet, will explain one-half of the difference of the standards set for these two types of institutions in Chapter 4. The reduction of five per cent in the space of private universities will amount to roughly one-quarter of the difference in the standards between the public and private institutions and bring to parity to the office space per FTE student in each one of these institutional types.

The absence of strong relationships between objective variables and space appears to mask the interesting conclusion that incremental differences between types of institutions is closely related to space standards established by this study, standards which are based on a reanalysis of expert opinion.

TABLE 6.1

PREFERRED REGRESSION EQUATIONS FOR NON-RESIDENTIAL SPACE

Group	R²	Standard Error	Regression Equation
Public Universities, FTE Enrollment less than 10,000	.81	210	NR-SPACE = -29.9 + .0828 FTE-ENR + .159 FTE-STF + 28.4 D-AG-D + 10.4 D-AR-D + 2.75 D-LF-D + 12.6 D-OS-D (.00979) (.0374) (7.30) (4.02) (.440) (5.05)
Public Universities, FTE Enrollment more than 10,000	.92	675	NR-SPACE = 562 + .382 FTE-STF (.0126)
Private Universities, FTE Enrollment less than 20,000	.92	227	NR-SPACE = 51.0 + .0385 FTE-ENR + .113 FTE-STF + 552 D-AG-B - 2.18 D-LF-M + 2.90 D-OS-B + 8.64 D-OS-D + (.0141) (.0251) (176) (.894) (.841) (1.72) - .298 D-OT-M + 2.57 D-OT-D + .0139 EXP (.141) (.808) (.00492)
Public Other Four-Year Schools, FTE Enrollment less than 5,000	.82	107	NR-SPACE = 30.4 + .0382 FTE-ENR + 2.16 D-AG-A + .0325 EXP (.00660) (.647) (.00137)
Private Other Four-Year Schools, FTE Enrollment less than 2,500	.75	50	NR-SPACE = 26.7 + .0142 FT-ENR + .271 FT-STF - .894 D-AR-M + 1.47 D-OS-B + .0325 EXP (.00649) (.0259) (.251) (.259) (.00297)
Private Other Four-Year Schools, FTE Enrollment more than 2,500	.93	119	NR-SPACE = 157 + .0267 FTE-ENR + .116 FTE-STF + 12.8 D-AG-B + 2.790 D-LF-M (.00617) (.0136) (2.40) (.650)

CHAPTER 7

AN ESTIMATE OF STOCKS 1970 - 1990

The U. S. Department of Health, Education, and Welfare, Office of Education, Report of the Higher Education Construction Programs Study Group[1] noted that "current accurate data on replacement needs for colleges and universities is not available" (p. 133). Arbitrarily, the study group assumed that one per cent of the space would be retired every year, and noted that this replacement estimate could be low, if the current backlog of unsatisfactory space (estimated at four per cent of the 1969 stock) were to be added to the replacement needs. It also noted that, by the end of the 1960's, a relatively high proportion of post-secondary space was fairly young, and that a rate of retirement lower than one per cent could be justified. On balance, the study group decided to adopt a one per cent rate.

The difficulty which the study group had in setting estimates of retirement is understandable. At the time the report was written, the group had at its disposal a snapshot of the age of instructional facilities in 1957. And this snapshot presented a confusing picture (see Table 7.1). For instance, nine per cent of all space still in use

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[1] Federal Support for Higher Education Construction: Current Programs and Future Needs, (mimeo, N.D.)

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in 1957 was occupied before 1900, and some 42 per cent was occupied before 1930. It is astonishing that the relation of degree credit enrollments in 1900 and 1930 was 8 and 38 per cent of those in 1956. Thus, if 1957 space standards were in effect throughout the 20th Century, it would imply that there was hardly any retirement of buildings during 60 years.

Actually, two related hypotheses can be more reasonably advanced: (1) space per student has been declining throughout the 20th Century, and (2) in all probability, retirements and abandonments occurred at a fairly modest rate throughout the period. This second hypothesis certainly supports the assumption of an average life of 100 years adopted by the study group.

New Evidence on Retirement Rates

We were dissatisfied with the method adopted by the study group to estimate the retirement rates of buildings. An attempt was made to establish better data bases and use more sophisticated retirement assumptions. In this, we were only partially successful.

Estimates of retirements were derived from an examination of actual retirements between 1957 and 1965. The reports submitted to the 1965 survey of facilities (still unpublished) were examined, and the type of construction, condition, principal use of buildings, and type of institution were noted for all buildings which were reported as being no longer in use. In effect, the voluminous file of responses for the 1965 survey was examined, and every building (with the exception of wooden buildings, for which a 20 per cent sample was taken) retired was noted. This file was later key-punched and sorted along the lines shown in Table 7.2. Ratios were calculated of occupied space to retired space and are shown in that table.

Two conclusions can be drawn from Table 7.2: (1) the age of a building does not correlate very highly with its retirement rate, and (2) the small number of retirements may cause wide fluctuations in the retirement rates of any single type of building. The total number of buildings retired for the entire eight-year period was 4,223, or less than 10 per cent of the total buildings and 6 per cent of the total space. This was not enough to make estimates for 63 cells, i.e., nine types of construction and seven time periods. For certain types of buildings, the retirement rate was calculated on the basis of one observation. Hence, the only reasonable way of estimating retirements appeared to be (1) to use all the observations for the eight years together, (2) estimate the average age of buildings in 1957, and (3) using the observed average retirement rate of buildings and their averages, estimate the life of buildings by reading off from a table (frequently used to estimate retirement rates for buildings) showing expectancy life-factors for group properties (the so-called R-2 retirement curve).[1] Since observed retirement rates were 0.8 per cent a year, and the average age of buildings was 25 years, it would appear that the expected average life of buildings is 75 years.

Using this retirement curve, we have estimated that a group of buildings comparable to the ones in stock in 1957 would have an average life of roughly 75 years. This does not mean (as the study group had assumed) that 1/75 of the stock would be retired every year. In reality, retirements are much slower in the early life of a building, and much faster as the building gets older. For instance, using the curve adopted, we have estimated that some 16 per cent of the buildings built before 1957 would be retired by 1990. The same curve applied to buildings built between 1957 and 1968 led us to an estimate of retirement of some five per cent of the stock of these buildings by 1990. The estimated stock of buildings in existence by 1970, and those surviving by 1990, are shown in Table 7.3. If our estimates are correct, even by assuming a shorter life for buildings, it is likely that retirement rates are going to be less than half of those projected by the study group.

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[1] A. Marston, R. Winfrey, J. C. Hempstead, Engineering Valuation and Depreciation, McGraw-Hill Book Company, Inc., New York, 1953, p. 462.

Total Stock of Buildings, 1973 - 1974

The total stock of buildings as of Fall 1973 is very difficult to estimate. The last usable HEGIS tape in our possession gives the stock of buildings in Fall 1970. At that time, the total stock of buildings was equal to 1,138 million net assignable square feet, of which 777 million square feet were non-residential buildings, and 361 million square feet were residential.

We attempted to estimate net additions to stock for the periods 1957 - 1968, and also academic years 1968 and 1969. These are shown in Table 7.4. A column of this table compares our estimates of gross additions to the space with those of the Norris report. We are fairly close in our estimates for the two years taken together, but our estimate is higher than the Norris estimate for 1968 and lower for 1969. We are not too concerned about these differences, because the Norris estimates are on a fiscal year basis, and ours are on an academic year basis.

The gross additions for academic years 1971, 1972, and 1973 are impossible to estimate accurately. The only estimates extant of expenditures for construction are from a survey published each year in June/July 1970 through 1974 in College and University Management magazine. These estimates are:

1969	$3,900	thousand
1970	3,572	"
1971	2,613	"
1972	2,829	"
1973	3,033	"

In constant prices, deflated by the index of construction costs, the estimated outlays (in 1957 - 1959 dollars) appear as follows:

1969	$2,799 thousand
1970	2,386 "
1971	1,641 "
1972	1,684 "
1973	1,715 "

In other words, after peaking sometime in the late 1960's, construction outlays have declined to roughly the $3.0 billion level in constant prices, or $1.7 billion in 1957-59 prices.

These outlays to higher education construction cannot be directly translated into the number of net assignable square feet built. Some of these outlays result in projects put in place a number of years later. The same source estimates that 46.1 million assignable square feet were put in place in calendar 1972, and some 60 million will be put in place in 1973.

We thus know that (1) some 120 million square feet were put in place in the academic years 1968 and 1969, and (2) we can estimate that 53 million square feet came on line in academic year 1972. Given the trends in appropriations for space, it would not be too out of line to assume that another 120 million square feet were put in place in 1970 and 1971, and that for the next few years, i.e., until 1975, one could expect some 40 million square feet to be put in place in each succeeding year.

The total space inventory for academic years 1975-76 and intervening years appears in Table 7.5. One could well expect an increase of 20 per cent in space between Fall 1970 and Fall 1976.

Distribution between Residential and Non-Residential Space

If past trends were followed, roughly one-third of the total space constructed would be residential space. In actual fact, this estimate is much too high. Already, between academic 1957 and academic 1968, about 30 per cent of the additions to space was residential space. By 1969, only 15 per cent of the space put in place was residential space. Since that time, there are no firm statistics of dormitory construction, but all indications are that dormitories are claiming a smaller and smaller proportion of the total space being built. If the decline in the proportion of space built between 1957 and 1965 (using 1962 as the midpoint) and 1969 were to be projected into the future, it is not unrealistic to assume that no more than 10 per cent of the space to be put in place from 1970 on will be residential. It is possible that the proportion may even be less.

The projections of residential and non-residential stocks appear in Table 7.6.

Other Withdrawals of Space

Between Fall 1970 and Fall 1971, roughly 1.7 million net assignable square feet were retired because 34 small schools closed down. The majority of these schools had lost enrollment, and had an average of 280 non-residential square feet per student in the private sector, and nearly 300 square feet among public schools.

There are roughly another 91 schools with very large inventories of space per student which are probable candidates for early closing. These schools have 23 million net assignable square feet, and are likely to be closed during the next four years. It is also possible that an additional 100 or so two-year and four-year schools in the private sector, with over 200-odd feet of non-residential space per student, may also find themselves in difficulty. These schools have an additional 30.5 million net assignable square feet in non-residential space. Of course, not all these schools will close, but it is not unreasonable to expect that perhaps half of them may go out of operation. Thus, some 40 million net assignable square feet, or 2.0 million a year, may be withdrawn through school closings. About one-third of that space is assumed to be dormitories, the rest is non-residential. It is not possible to forecast how these closings will be phased, and we arbitrarily subtracted an equal amount each year. For instance, in the Fall of 1974, Parsons College, with roughly half a million square feet of non-residential space, will be withdrawn from the inventory.

Rented Space

Rented space was estimated at 32 million square feet in 1969-70 and 29.5 million square feet in 1970-71. These figures, which account for less than three per cent of the total space and four per cent of the non-residential space (most of the reported rented space is non-residential space), should be treated with great caution. In a number of instances, the inclusion of rented space produced extremely high space available per student. Discreet inquiries for the reasons why such large amounts of space were rented produced varying responses: (1) in some cases, the total space rented from a high school to offer night courses for a few hours an evening was reported, (2) in other cases, the reported space was used mostly to locate a research group, and a few ancillary courses were given at the location, and (3) in at least one instance, the rented space was being converted and only a minute part was ready for occupancy. On balance, we could only conclude that the role of the relatively small proportion of rented space is highly overestimated.

Given the stories about crises in the availability of space in some institutions, we were quite surprised about the insignificant role which rented space has played in filling peak demand before permanent facilities became available. In this connection, we investigated in depth the experience of the CUNY system, one of the post-secondary systems with the least facilities per student, the lowest office footage per staff member, and with generally unsatisfactory auxiliary facilities. The system is located in the largest metropolitan area in the country, which has been experiencing above-average vacancies in office space. Hence, on the surface, it appeared reasonable that it could fill its requirements in existing facilities.

Actually, there were a number of factors which prevented the system from expanding its space requirements as fast as it wanted to through rentals. In the first place, much of the expansion was not in Manhattan, but in outlying boroughs where community colleges were set up to cater to disadvantaged populations. There was little space for rent there, and the system had to wait until space became available in churches, synagogues, or community centers. For instance, Medgar Evers Community College is housed in a former Masonic Temple, a Presbyterian church, and assorted other office buildings. Other community colleges were housed in Jewish Centers or closed parochial high schools. Another four-year school holds gym classes in a YWCA.

Often a factory was the only available building in the community considered suitable for the college, and modification costs were high enough to prompt the purchase and remodeling of the facility as contrasted to renting it.

In a number of existing schools outside the borough of Manhattan, trailers were wheeled in for use as offices and classrooms. In other instances, a whole campus, such as St. John's in Brooklyn, was taken over.

In Manhattan itself, CUNY found itself a less-than-welcome tenant in high-rise buildings. The rush of students from classroom to classroom at set periods tended to disrupt elevator service for other tenants. Also, in the case of existing schools, such as Bernard Baruch and Hunter, the choice of space was limited by the desire to keep some propinquity between students and faculty. At Baruch, freshmen and sophomores were located in a nearby building, and faculty offices were sited in a nearby hotel.

The problem of locating a portion of a campus in rented space has not been solved satisfactorily, either by CUNY or other fast-growing campuses. It is difficult and uneconomic to site part of a school in one location and part in another, especially if the institution wishes to provide some library and study facilities.

The economics of refurbishing and renting space are also moot. CUNY, for instance, paid between $5.00 and $8.00 a net assignable square foot for space in downtown Manhattan. The higher figure, it is true, included maintenance and cleaning fees estimated at $1.50 a square foot. In other locations, uptown, space was rented at $3.00 to $4.00 per square foot. The average cost of trailers was roughly $5.00 per square foot, on a declining payment scale from $12.00 to $3.50 a net available square foot over a five-year period. The cost of trailers is somewhat exaggerated, since CUNY could purchase them for a nominal amount at the end of five years, and the useful life of trailers was estimated to be, at least, double the rental term.

Another fast-growing system, the state colleges in California, has also experimented with rentals, again with indifferent success. As some privately built dormitories were underutilized, some of the residential space was rented and converted into faculty offices. According to administrators of programs, this was not a satisfactory solution either, as commuter students found the location of offices inconvenient. Lately, surplus classrooms in the system were converted into faculty offices, as a preferable alternative. Complaints that these offices are makeshift are still heard, but they are considered more satisfactory than more gracious facilities in inconvenient locations.

The only successful rental experience we have heard about is that of a proprietary school in New York. It leased its campus to CUNY and rented long-term office space. The principals of the school managed to reduce their space requirements by one-half, from some 40 to 20 square feet per full-time-equivalent student. They claim that this reduction in space could be accomplished in other schools through better space planning. It should be mentioned, though, that the school provides few, if any, of the conventional amenities of college campuses: its library is limited, there are no food or athletic facilities, etc. We were told that a separate bank of elevators services for the school reduces complaints from commercial tenants.

Attitude Toward Space and Future Construction Plans

To many college and university administrators, especially in private schools and universities, the campus is an important entity which has practically a life of its own. An illustration of the aspirations of a major university center, which has roughly twice the "standard space" per student is reproduced in Exhibit I.

There is no end to what can be improved, and standards set by one institution are generally copied by others. For instance, the layout of campuses planned by CUNY does not take into account that CUNY is part of the metropolitan area. A theater built at Staten Island Community College was reviewed by a professional publication as rivaling in facilities those of Broadway.

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Exhibit I - A Private University President's Point of View

Revitalizing the Divisional Structure

Physical facilities, of course, are only justified if they importantly further important activities. The structures which I have mentioned have been put to this test. But it hardly needs saying that the maximization of the University's strength involves different problems as well. Two years ago Dean Jacobson appointed a faculty committee to review the organization of the Basic Biological Sciences. That committee reported in February 1972. "A central conclusion and main theme of the committee," the report states, "is that a considerable degree of unity, cohesiveness, and flexibility in the Basic Biological Sciences are absolutely essential both now and in the future and this requires both administrative steps and explicit policies that go beyond simple exhortations of collegiality. There would seem to be little doubt that biology is becoming in many ways a single discipline or at least a multi-dimensional continuum of overlapping disciplines." "At our own institution," the report goes on the say, "departments overlap in their (legitimate) interests; much of our divisional strength presently lies across departmental lines; we find ourselves unable to keep teaching responsibility confined within departments; and there is an increasing need for kinds of laboratories and of expensive specialized facilities that are not unique to individual departments If our divisional enterprise in the basic biological sciences is to be strong and balanced, there is the need, especially in the face of current restraints, to consider the impact of departmental appointments on overall programs and responsibilities in the basic sciences, and one can only suspect that our future abilities to recruit outstanding students and faculty in new frontier areas of biology will depend on our attractiveness on a divisional basis." Among the recommendations of the committee was "that there be fewer and larger basic science departments." The committee recognized the need for the "continuing use of interest groups formed for scholarly purposes on a nondepartmental basis." At the present time the Division is considering recommendations for two consolidations in the light of the direction of this general report. Biophysics, Theoretical Biology, and part of Physiology will be brought together in one department. Pharmacology and the rest of Physiology, it is proposed, will form another.

The report of the faculty committee on the Organization of the Basic Biological Sciences suggests questions which are appropriate for all the Divisions. Questions of this type are now before the Social Sciences Division with the recommendation of its faculty committee that in view of the presence of something like 65 psychologists and closely related behavioral scientists in various parts of the University, including the Business School, the Department of Psychiatry, the Department of Biology, the Department of Education, and the Committee on Human Development, as well as the Department of Psychology, there be a serious effort at regrouping. But the number and overlapping of departments are not the only issues which the basic biology report may be taken to raise. Inherent in the report are questions as to the reality of the possible collective leadership role of the Divisions themselves. This role, no doubt, is a changing one, depending on many external and internal factors and other supporting arrangements. The early organization of the Social Sciences Division surely reflected a belief in the possibility of interchange and divisional leadership. The Social Sciences Research Building, the first of its kind, was intended as a divisional laboratory, given added meaning through the use of multi-department seminars, interdisciplinary committees, and the integrative force of the Social Sciences Research Divisional Grants Committee. This may well be a time when, as the report seems to suggest, it may be necessary to give new vitality to the divisional structures. I am, myself, convinced that the institution of the Collegiate Divisions at the undergraduate level has increased our ability to solve educational problems. The main reason for this is because of the facilitating efforts of the Masters themselves. One wonders whether similar efforts at the divisional level might not prove to be useful.

Source: Edward H. Levi, "State of the University," The University of Chicago Record, Vol. VII, No. 3, March 21, 1973, p. 42, the University of Chicago.

We do not believe that many systems will have space shortages because: (1) the space standards they have adopted are generous, and (2) state and local funds are still allocated on the assumption that enrollments will increase in line with past trends. In effect, a number of administrators believe that there is a 10 to 20 per cent leeway in capacities on campuses, especially those campuses which deal with "non-elite" clienteles, and where the faculty has less say about class size. Also, the plans of such states as New York have not been revised downward in the light of recently reduced propensities to enroll. While the latest published census figures show that only half of high school graduates attend colleges, New York State plans to provide facilities for seventy per cent. The master plans of most other states are also somewhat high in the light of most reasonable projections of enrollments.

In some states, the central administration is becoming increasingly aware of the optimism of earlier projections of enrollments. Administrators of both the university and college system in California are attempting to put the brakes on additional construction. Their message is not read loud and clear at individual university and college sites. In a number of schools we visited, the administration was still committed to meet the construction schedule of a master plan which was based on much higher enrollment projections.

Without looking into the array of political forces in each individual state, it is impossible to forecast who will win the tug-of-war between the local and central administrations. If the forecast of College and University Management for calendar 1973 is to be trusted, the political power is in the hands of the local administrators. As the economy moved into high gear in 1972, the appropriations for construction increased some 15 per cent!

TABLE 7.1

SURVIVING SPACE IN 1957, AND ENROLLMENTS FOR SELECTED PERIODS

	Through 1899	1909	1919	1929	1939	1949	1957	Total[a]
Gross space (thousands of square feet), cumulative by date of occupancy	56,085	102,613	162,240	269,173	358,878	468,829	636,087	639,878
Degree credit enrollment (thousands)	238	355	606	1,157	1,644	2,902	3,014[b]	
Index of surviving space (1957 = 100)	8.8	16.0	25.4	42.1	56.1	73.3	99.4	100.0
Index of enrollments	7.9	11.8	20.1	38.4	54.5	96.3	100.0	

[a] includes buildings not reported by initial occupancy.

[b] 1956.

Source: Space: College and Universities Facilities Survey: 1952, Department of Health, Education, and Welfare, Office of Education, U. S. Government Printing Office, Washington, D. C., 1965, pp. 223-226. Enrollments: Historical Statistics of the United States: Colonial Times to 1952, Bureau of the Census, Department of Commerce, p. 210.

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TABLE 7.2

SPACE RETIRED, 1957 THROUGH 1965, ASSIGNABLE SQUARE FEET, AND PERCENTAGE OF ALL SPACE BY TYPE OF CONSTRUCTION

(Square Feet in Hundreds)

Type of Construction	Date Built Before 1899	1900-1909	1910-1919	1920-1929	1930-1939	1940-1949	1950-1957	Total	Per Cent of Existing Space Retired
Wood frame	318	1,526	1,041	2,032	1,751	20,714	2,572	29,954	.0625
Wood frame with masonry veneer	3,222	6,068	1,354	1,164	805	2,924	1,510	17,047	.0911
Load-bearing masonry walls and wood	15,479	9,864	9,805	6,431	3,376	4,989	5,004	54,948	.0708
Load-bearing masonry walls and steel	1,237	1,833	4,650	3,242	11,007	5,224	10,767	38,010	.0428
Steel skeleton and masonry walls	2,684	1,976	8,257	2,893	4,665	1,741	5,204	27,420	.0386
Lift-slab reinforced concrete				634		28	2,640	3,302	.0552
Reinforced concrete	41	1,120	4,804	16,591	14,256	10,163	27,722	74,697	.0662
Quonsets and temporary steel buildings		59	8	47	26	6,275	725	7,140	.1497
Other	1,201	182	1,175	1,403	3,247	5,795	9,255	22,258	.1757
Totals	24,232	22,628	31,094	34,437	39,133	57,853	65,399	274,776	.0624

Source: Based on 20 per cent sample of retired wooden buildings, and a 100 per cent enumeration of other buildings, from U.S.O.E. unpublished records; College and University Facilities Survey: 1957, Department of Health, Education, and Welfare, Office of Education, U. S. Government Printing Office, Washington, D.C., 1965.

TABLE 7.3

ESTIMATED STOCK OF TOTAL SPACE IN EXISTENCE BY 1970 AND SURVIVED TO 1990

(Net Assignable Square Feet in Millions)

Survived to	Built by 1957	Built Between 1957 - 1968	Built in 1968	Built in 1969	Total Stock
1968	413.3	613.7			1,027.0
1969	410.6	612.7	72.6		1,095.9
1970	407.7	611.8	72.5	46.9	1,138.9
1971	404.0	610.6	72.4	46.9	1,133.9
1972	401.2	609.3	72.3	46.8	1,129.6
1973	397.5	608.1	72.2	46.7	1,124.5
1974	394.1	606.9	72.1	46.7	1,119.8
1975	391.0	605.6	71.9	46.6	1,115.1
1976	387.1	604.4	71.9	46.5	1,109.9
1977	383.5	603.2	71.7	46.4	1,104.8
1978	380.2	601.9	71.6	46.3	1,100.0
1979	376.1	600.1	71.4	46.2	1,093.8
1980	372.2	598.8	71.3	46.1	1,088.4
1981	368.7	597.0	71.1	46.1	1,082.9
1982	364.4	595.1	71.0	46.0	1,076.5
1983	360.0	593.9	70.9	45.9	1,070.7

TABLE 7.3 (Cont'd)

ESTIMATED STOCK OF TOTAL SPACE IN EXISTENCE BY 1970 AND SURVIVED TO 1990

(Net Assignable Square Feet in Millions)

Survived to	Built by 1957	Built Between 1957 - 1968	Built in 1968	Built in 1969	Total Stock
1984	356.6	592.0	70.7	45.8	1,065.1
1985	352.5	590.2	70.5	45.7	1,058.9
1986	347.7	588.3	70.3	45.5	1,051.8
1987	343.8	585.9	70.1	45.4	1,045.2
1988	339.1	584.0	69.9	45.3	1,038.3
1989	334.5	582.2	69.8	45.2	1,031.7
1990	330.4	579.7	69.6	45.1	1,024.8

Source: See text, p. 169.

TABLE 7.4

ADDITIONS TO NON-RESIDENTIAL STOCK OF POST-SECONDARY BUILDINGS BY YEARS

(Millions of Net Assignable Square Feet)

	Total Stock	Built	Square Feet	Survived			
				Pre-1957 Stock	1957 - 1968 Additions	1968	1969
Fall 1968	1,027.0	1957 - 1968	618.0	413.3	613.7	--	--
Fall 1969	1,095.9	1968 - 1969	72.6	410.6	612.7	72.6	--
Fall 1970	1,138.9	1969 - 1970	46.9	407.7	611.8	72.5	46.9

Source: 1968, 1969: Federal Support for Higher Education Construction: Current Programs and Future Needs, U. S. Department of Health, Education, and Welfare, Office of Education, Report of the Higher Education Construction Programs Study Group, Chalmers G. Norris, Chairman.

1970: See text, p. 170.

TABLE 7.5

ESTIMATED SPACE BUILT AND SURVIVED BY 1975

(Net Assignable Square Feet in Millions)

A. Total Space

Built	Built Before 1970	Built in 1970-71	1972	1973	1974	Total Stock
1970	1,138.9					1,138.9
1971	1,133.9	) 120.0				n.a.
1972	1,129.6	)				1,240.6
1973	1,124.5	119.8	53.0			1,297.3
1974	1,119.8	119.6	52.9	40.0		1,332.3
1975	1,115.1	119.4	52.8	40.0	40.0	1,367.3

B. Residential Space

Built	Built Before 1970	Built in 1970-71	1972	1973	1974	Total Stock
1970	361.5					361.5
1971	359.9	) 12.0				n.a.
1972	358.5	)				370.5
1973	356.9	12.0	5.3			374.2
1974	355.4	12.0	5.3	4.0		376.7
1975	353.9	11.9	5.3	4.0	4.0	379.1

C. Non-Residential Space

Built	Built Before 1970	Built in 1970-71	1972	1973	1974	Total Stock
1970	777.4					777.4
1971	774.0	) 108.0				n.a.
1972	771.1	)				879.1
1973	767.6	107.8	47.7			923.1
1974	764.4	107.6	47.6	36.0		955.6
1975	761.2	107.5	47.5	36.0	36.0	988.2

Source: See text, p. 172.

TABLE 7.6

ESTIMATED SPACE BUILT BY 1975 AND SURVIVED TO 1990

(Net Assignable Square Feet in Millions)

A. Total Space

Built	Built Before 1970	Built in 1970-71	1972	1973	1974	Total Stock
1975	1,115.1	119.4	52.8	40.0	40.0	1,367.3
1980	1,088.4	118.3	52.5	39.6	39.7	1,338.5
1985	1,058.9	117.0	51.9	39.3	39.4	1,306.5
1990	1,024.8	115.4	51.4	38.8	39.0	1,269.4

B. Residential Space

Built	Built Before 1970	Built in 1970-71	1972	1973	1974	Total Stock
1975	353.9	11.9	5.3	4.0	4.0	379.1
1980	345.5	11.8	5.2	4.0	4.0	370.5
1985	336.1	11.7	5.2	3.9	3.9	360.8
1990	325.3	11.5	5.1	3.9	3.9	349.7

C. Non-Residential Space

Built	Built Before 1970	Built in 1970-71	1972	1973	1974	Total Stock
1975	761.2	107.5	47.5	36.0	36.0	988.2
1980	742.9	106.5	47.3	35.6	35.7	968.0
1985	722.8	105.3	46.7	35.4	35.5	945.7
1990	699.5	103.9	46.3	34.9	35.1	919.7

Source: See text, p. 172.

CHAPTER 8

PROPRIETARY POST-SECONDARY SCHOOLS

The number of students enrolled in vocational, non-degree, programs in predominantly non-profit institutions enumerated in HEGIS has increased apace in each of the past three years. Concurrently, enrollments in for-profit schools, most of which are not included in the survey, have either remained stable or declined. Preliminary results of a special study commissioned by NCES, which used a Current Population Survey sample to estimate enrollments of adults past compulsory school age in private, proprietary trade and vocational schools, indicates a decline in total enrollment of some seven per cent between 1969 and 1971. Even if one were to allow for the imprecision of the sample survey, there is very little evidence that the demand for vocational training has spilled over into the profit sector. On the contrary, it appears that the proliferation of publicly subsidized programs has arrested the growth of the proprietary schools. The recent financial difficulties of some correspondence schools with a national following are witness to this trend. As best as can be determined from the above-mentioned survey, 1.4 million students were enrolled in proprietary schools as of 1971. Roughly a third were taking courses by correspondence and did not require formal instruction space. It is difficult to estimate the full-time-equivalent load for the remainder of the students, since many participated in more than one program. Our best informed estimate is some 600 to 800 thousand FTE students, based on the median number of class hours.

Advantages of Proprietary Schools

Proprietary school owners whom we interviewed are quite upset about the unfair competition of tax-subsidized vocational programs, which offer substantially the same training as proprietary schools. The recent trend in the post-secondary sector to encourage "open admission" programs for all high school graduates has further shrunk the market for proprietary schools which have catered to students of sub-post secondary ability.

The advantages of proprietary schools are still maintained in a few cases: (1) where specific technical training is required, (2) where students opt for short training courses and try to avoid being burdened by general educational requirements, and (3) where the placement function is extremely important.

In such fields as data-processing and electronics, a number of schools--some affiliated with major industrial companies, others free-standing--have carved themselves a niche in the post-secondary sector by offering up-to-date, practical training. In many cases, especially in the case of data-processing schools, their appeal to students is based both on their technical competence and promises of job placement. Following an investigation of the Federal Trade Commission, the promises of jobs have been de-emphasized in the publicity of some schools, and hence the power of their advertising appeal has been reduced.

More narrowly focused schools, teaching a given cluster of skills and little else, have also been prominent in the proprietary sector. Besides auto-mechanic schools, schools for welders, etc., such schools as the ones for medical assistants and beauticians have had fairly narrow-gauge curricula which appeal to strictly vocationally oriented students.

There is considerable controversy surrounding the quality of schools which train medical and laboratory assistants. The association of non-profit, university- or hospital-affiliated schools has claimed that the recruitment or proprietary medical technical schools is haphazard (the public relations representative of the non-profit association promoted a story on the front page of the Washington Post by enrolling her dog in one of these schools), that the courses are substandard, and are taught by a part-time faculty. Operators of proprietary schools, in reply, have mustered data about successful career stories of graduates. Whether the criticism of these schools is relevant or not, it has certainly limited the popularity of this type of school.

Finally, secretarial and commercial schools are probably the epitome of the third type of school, where placement services are most important. As placement services of junior colleges improve, it is quite likely that these schools, too, will be threatened.

Character of Proprietary Schools

The proprietary school sector, with a few exceptions of nationally franchised or large-company schools, is truly competitive, marginally profitable, and characterized by a high rate of entry and exit. For instance, there were 5,019 proprietary schools in 1971.[1] A survey of a sample of these schools in 1973, conducted by the National Commission on the Financing of Post-Secondary Education, failed to contact roughly 30 per cent of these schools, leading to the strong presumption that they were out of business.

As of 1971, proprietary schools were distributed as follows: 423 were technical/vocational, 161 were technical institutes, 940 were business and commercial, 1,475 were schools of cosmetology, 1,332 were flight schools, 112 were correspondence schools, 47 were hospital schools, and 509 were trades schools. An additional 20 were classed as "other."

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[1] Adapted from Table 3, p. xix, Directory of Post-Secondary Schools with Occupational Programs, 1971, U. S. Office of Education/ National Center for Educational Statistics (Washington, D. C.: Government Printing Office, 1973), as cited in Financing Post-Secondary Education in the Last Quarter of the Twentieth Century, the report of The National Commission on the Financing of Post-Secondary Education.

Of the 1.4 million adults enrolled in these schools, some 400 thousand were enrolled in part-time correspondence courses, and studied at home. Nearly half of the remaining students, 475 thousand, attended classes in a building dedicated to instruction; some 320 thousand were housed in commercial buildings; with the remaining 20 per cent receiving instruction in a wide variety of locations, most of them not specified.

Most proprietary schools are small. With the exception of technical/vocational and technical institutes, where the average enrollment is somewhat above 400 students, the majority of other schools have FTE enrollments of around 200 students, e.g., secretarial and trade schools, or 100 or less, as is the case with cosmetology and hospital schools. Hence, the amount of space required per school is not very large.

Requirements for Space by Type of School

In the case of the technical/vocational schools, two appear in the HEGIS survey: the RCA Institute and the New York Institute of Technology. These are fairly large institutions with between 30 to 50 square feet per FTE student. Recently Bell & Howell constructed two model technical training facilities with capacity for roughly 2,000 students each. Forty square feet per student were provided.

New York State has collected statistics on 23 proprietary schools which have been approved by the State. Most of the schools are either business/secretarial or teach data-processing. The average number of square feet per student there is roughly forty, as well (see Table 8.1).

Other state departments of education, although they license and inspect proprietary schools, do not keep records of facilities. Hence, the estimates of space for cosmetology and hospital and medical technicians is not readily available. Telephone inquiries to the offices of larger schools listed in telephone directories of three large cities did not elicit very specific estimates. As nearly as we could determine, cosmetology schools run two shifts, and, if enrollments were up to capacity, could accommodate students in 30 square feet per student. Medical technician schools, according to the statement of a franchiser and the operators of another school, require some 45 square feet of space per student. In all cases, we were told that roughly two-thirds of the area was for instructional space, and the rest for administrative space.

Availability of Space for Proprietary Schools

One of the principal difficulties of determining how much space is either required or available for proprietary school students is the great reticence of school operators to give information to a study financed by any level of government. Our conversations left the definite impression that junior college vocational programs were seriously undercutting the market for these schools. This situation was well recognized by the operators, who implied that they had more capacity than students.

Similar conclusions can be drawn from a four-city study of current enrollments and operating capacity of four types of proprietary schools conducted in 1971.[1] In the case of office, computer, and technical schools, the capacity was, on the average, some forty per cent above enrollments. In health schools, the capacity was nearly three times the enrollment (see Table 8.2).

Table 8.2 shows mean and median enrollments, as well as mean and median capacities. As a general rule, the median school has fewer students than the average school, and the median capacity is higher than the mean capacity. This statistic leads one to deduce that there is more underutilized capacity in the smaller schools than in the larger ones. This conclusion is buttressed by the observation that the schools with the smallest average enrollment, the health schools, have the greatest unused capacity. It would seem that the unfavorable competitive situation of proprietary schools has affected small schools more severely than the larger ones.

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[1] Jean M. Wolman, Vincent N. Campbell, Steven M. Jung, James M. Richards, A Comparative Study of Proprietary and Non-Proprietary Vocational Training Programs, Volume I, American Institutes for Research, Palo Alto, California, Final Report under Contract No. OEC-O-70-5018.

Can Space Standards Be Established for Proprietary Schools?

The above-mentioned study of vocational training programs compared programs in proprietary and non-proprietary schools. The findings of this study are that the two sectors have different approaches to their missions. The non-proprietary sector stressed remedial instruction in basic skills, while the proprietary schools emphasized hands-on, laboratory experience. As a general rule, classes in proprietary schools were smaller, and the proportion of time spent in laboratories was greater than in non-proprietary schools. The most striking deficiency of facilities in proprietary schools was in the library sector. Little library or study space was provided in proprietary schools.

It appears that the instructional facilities of proprietary vocational schools are adequate for their programs. It is not at all clear that library and study space are really needed by students, given the hands-on character of the programs offered. The evidence on this score is equivocal. A survey of hours of homework by students in proprietary schools indicates that a vast majority did have homework. Whether they would have benefited from study and library facilities is moot.

To summarize, the facilities of proprietary schools appear Spartan compared to those of the rest of the post-secondary sector. The 40 square feet per student, though, seem adequate for the missions chosen by these schools. There is little evidence about shortages of facilities; on the contrary, with stiff competition from publicly subsidized programs, the evidence points to an excess of capacity. This excess capacity may be further accentuated as enrollments decline, because roughly one out of five students finances proprietary school tuition with public funds, i.e., mostly Veterans' benefits. As the number of veterans declines, the enrollments in proprietary schools are likely to be affected even more adversely.

Issues for Federal Policy

The stock of buildings needed for proprietary instruction is not very big compared to the stock of buildings in the non-profit sector. Of the 600 to 800 thousand FTE proprietary school students receiving face-to-face instruction, at least 10 per cent (those in flight training) require no specialized buildings. Hence, no more than 2.5 - 2.8 million net available square feet are required to accommodate proprietary students. It appears that more space than is required by present enrollments is already in place. Also, if the same standards with respect to subsidy were in force for proprietary programs as are currently in force with respect to scholarships, and all programs of less than six months were ruled ineligible, at least 80 per cent of proprietary programs would be outside the scope of any program.

Small subsidies for acquisition or rental space will not remove the substantial competitive disadvantage which these schools have in relation to the subsidized public junior college sector. Higher tuition fees in the public sector would have to be introduced to remove this disadvantage.

TABLE 8.1

PROPRIETARY SCHOOLS, NEW YORK, FULL-TIME-EQUIVALENT ENROLLMENT AND SPACE PER FULL-TIME-EQUIVALENT STUDENT

Name of Institution	FTE Enroll-ment	Square Feet per FTE				Total
		Class	Lab	Class + Lab	Other	
Berkeley Claremont (Hicksville)	206	14.08	16.82	30.90	26.46	57.36
Berkeley Claremont (New York City)	288	6.08	19.53	25.61	14.27	39.88
Berkeley School (White Plains)	600	11.67	9.56	21.23	15.32	36.55
The Wood School	240	14.96	9.44	24.40	12.48	36.88
Albany Business College	300	37.85	14.43	52.28	69.57	121.85
Collegiate Institute	275	30.89	6.60	37.49	12.08	49.57
Interboro Institute	300	9.47	7.17	16.64	8.89	25.53
Jamestown Business College	225	10.09	9.60	19.69	17.38	37.07
Olean Business Institute	133	16.69	11.77	28.46	17.22	45.68
Powelson Business Institute	338	6.10	14.65	20.75	15.32	36.07
Bryant/Stratton Business Institute	1,800	7.91	8.72	16.63	16.63	33.26
Tobe-Coburn School of Fashion Careers	165	10.92	--	10.92	22.69	33.61

TABLE 8.1 (Cont'd)

PROPRIETARY SCHOOLS, NEW YORK, FULL-TIME-EQUIVALENT ENROLLMENT AND SPACE PER FULL-TIME-EQUIVALENT STUDENT

Name of Institution	FTE Enroll-ment	Square Feet per FTE				Total
		Class	Lab	Class + Lab	Other	
Taylor Business Institute	511	12.68	11.93	24.61	8.28	32.89
Katherine Gibbs School	950	10.03	6.24	16.27	12.40	28.67
Utica School of Commerce	200	21.65	8.76	30.41	10.19	40.60
Laboratory Institute of Merchandising	200	17.45	--	17.45	17.64	35.09
Central City Business Institute	380	23.13	20.45	43.58	104.55	148.13
RCA Institutes	2,240	6.97	11.73	18.70	15.72	34.42
American Academy of Drama & Arts	313	5.58	29.47	35.05	36.50	71.55
All Institutions	9,664	11.43	11.49	22.49	20.61	43.10

Source: New York State Department of Education, unpublished records.

TABLE 8.2

SUMMARY OF CURRENT ENROLLMENT AND OPERATING CAPACITY FOR PROPRIETARY SCHOOLS BY OCCUPATIONAL AREA AND CITY

	N	Average Current Enrollment		Total Enrollment	Average Estimated Capacity		Total Capacity	Ratio: Capacity/ Enrollment
		Mean	Median		Mean	Median		
Office								
Atlanta	6	117	17		229	150		
Chicago	4	96	57		166	137		
Rochester	6	51	12		193	102		
San Francisco	8	96	27	1,392	225	55	1,800	1.29
Computer								
Atlanta	5	80	57		126	122		
Chicago	6	256	214		362	325		
Rochester	1	50	50		226	226		
San Francisco	6	103	70	2,604	233	180	3,796	1.46
Health								
Atlanta	6	63	51		185	162		
Chicago	5	44	31		121	100		
Rochester	2	28	28		127	127		
San Francisco	6	50	54	954	126	153	2,725	2.86

TABLE 8.2 (Cont'd)

SUMMARY OF CURRENT ENROLLMENT AND OPERATING CAPACITY FOR PROPRIETARY SCHOOLS BY OCCUPATIONAL AREA AND CITY[1]

		Average Current Enrollment			Average Estimated Capacity			
	N	Mean	Median	Total Enrollment	Mean	Median	Total Capacity	Ratio: Capacity/ Enrollment
Technical								
Atlanta	3	170	25		323	100		
Chicago	3	995	210		1,223	400		
Rochester	1	42	42		60	60		
San Francisco	2	188	188	3,913	312	312	5,322	1.36

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[1] N = number of schools reporting current enrollment. Estimated capacity was frequently based on an N somewhat smaller since not all reporting schools provided capacity figures also. Where N = 1, the school's actual enrollment and capacity figures are provided in the mean and median columns.

Source: Jean M. Wolman, Vincent N. Campbell, Steven M. Jung, James M. Richards, A Comparative Study of Proprietary and Non-Proprietary Vocational Training Programs, Volume I, American Institutes for Research, Palo Alto, California, Final Report under Contract No. OEC-O-70-5018.

CHAPTER 9

COST OF CONSTRUCTION

Increases in costs of construction have been abundantly documented in a number of publications. Undoubtedly, the cost of building, which has increased apace during the past decade, will continue to grow. The *College Management* building index (reproduced in Table 9.1) shows that the cost of erecting a standard college facility has risen by 75 per cent in the course of the past ten years. This index behaves roughly in the same manner as the Department of Commerce composite construction index. Both indexes have grown faster than the cost of living by about one per cent a year.

Difficulties of Forecasting Future Construction Costs

The future costs of building depend not only upon the behavior of the general price index in future years, but also on practices in the construction industry, and on the health of the construction industry itself. In the course of the past two years, the Productivity Council has actively negotiated with craft unions to permit streamlining of practices at building sites. Also, high interest rates and shortages of mortgage funds have depressed the volume of new housing starts. Both of these developments tended to arrest the growth of construction costs. Building costs increased somewhat slower in 1972 and 1973 in relation to the cost of living as compared to the previous period. Whether recent price increases of lumber and other construction costs will reverse this trend is not known.

The influence of the type of building erected on the cost of construction may result in variations of costs per square foot even more drastic than those which result from variations of the price levels. Different types of buildings cost differing amounts to build. Cheapest among post-secondary buildings are garages, next are dormitories; instructional buildings in 1972 cost slightly more than the average, while laboratories and, especially, medical facilities were most expensive of all (see Table 9.2). During a given year, the varying mix of buildings completed or contracted for can affect prices paid per square foot quite drastically.

In addition to variations in cost by type of building, variations in the type of construction can affect the cost of new space, whether the construction is that of a brand-new building, or an addition to an existing building. *A priori*, the cost of additions should be a fifth less per square foot. In fact, a considerable number of additions of minimal space cost two or three times as much per square foot as new buildings. Follow-up of these anomalies revealed that in those cases considerable rehabilitation of existing facilities was included in the price of the project.

An analysis of the College Management tape revealed that variations of cost per square foot by projects state by state, or within urban areas of a group of states, vary quite drastically. A detailed analysis of costs could not be undertaken because differences between average costs were not statistically significant.

On the other hand, there is no doubt that regional price differences exist. It appears that the highest costs are incurred in the Northeast and in West Coast states, while the lowest cost experience is in the South. Costs in Midwestern and some Mountain states fall in between these ranges (see Table 9.3).

Nevertheless, even when results for groups of states are aggregated, the year-to-year variations, as shown in Table 9.3, are quite random. They may be due to a variety of causes: differences in the types of buildings, variations in specifications, tightness of the local labor market, etc.

The large variations in costs of similar buildings, say classrooms, is staggering. In 1970-72, some classrooms were completed at a cost of \$17 - \$22 per square foot, while the average cost per assignable square foot of classrooms exceeded \$40 - \$45. Equally wide variations were recorded in costs of dormitories.

The pioneering work of the Educational Facilities Laboratory (EFL), which has documented the savings made possible with prefabricated, modular buildings, is not widely accepted. The desire to harmonize the architecture of new buildings with the old, the desire of college presidents and donors to erect unusual and interesting buildings, the increasing trend to involve faculty, students, and even community agencies or individuals in the planning of campuses have conspired to limit the acceptance of "fast-track" modular buildings. EFL personnel argue that, by the time a new facility is ready, a significant part of the faculty which planned it will no longer be employed by the institution. The turnover of students and the change in the composition of community leaders' priorities between the planning period and occupancy is likely to be even more drastic. EFL claims that custom-planned buildings are built for phantoms, since the cycle of planning, consultation, and subsequent custom building takes some three years to complete from inception to occupancy.

Probable Levels of Construction Costs

The average cost of a square foot of assignable space exceeded $52 in 1973. With inflation at a high level in 1973-74, it is probable that space contracted for in 1974 will cost some $57 a square foot.

The current consensus among economists is that inflation will continue at five per cent or so a year, and it is quite likely that shortages of cement, steel, and lumber will push prices of building up faster than the inflation level, with average costs rising at six or seven per cent a year.

As more and more construction is concentrated upon library and laboratory buildings, the actual costs to colleges may be five or ten per cent higher than the actual trend indicates. The considerable jump in average costs per square foot between buildings completed in 1972 and 1973 and those planned in 1973 partially reflects this shift. It will be remembered that the majority of buildings completed during these years were contracted for three years earlier.

Costs of Rehabilitation and Refurbishing

If our pessimism about the future levels of enrollments proves correct, the major effort of most campus planners will no longer be centered upon expanding or building new campuses, but will be mostly concerned with rehabilitation and refurbishing.

The Norris Committee estimated that roughly 10 per cent of the plant as of 1968 needed rehabilitation. We interviewed four state space planners, several officials charged with a given public institution's facilities, and half a dozen private school planners, and came away with a slightly different impression. We concluded that no more than five per cent of the public sector plant was substandard. However, proportions varied considerably from campus to campus. Thus, the New York City public and private plant was in much worse shape than facilities elsewhere.

Part of the substandard plant in the public sector consisted of older dormitories and, often, of smaller buildings, mostly wood or stucco, which were taken over by the college as the campus expanded. Many of the older dormitories were being razed, and some of the smaller buildings which were used to house small research groups were also being abandoned, as support for research programs was drying up. We were surprised to find that a number of temporary buildings had been refurbished for special purposes--a laboratory on some campuses, an art studio on others--and were considered by their occupants as superior to alternative accommodations in more recently erected structures.

The extent of non-maintenance in major state systems is negligible. Roofs, safety railings, etc., were kept in good repair. The skimping, or stretch-out, between replacements was mostly on marginal items such as painting, hardware (especially windows and blackboards), and to some extent ground maintenance and cleaning. Some progress was being made in mechanizing these last two functions, and a considerable cost savings realized.

The problems most often cited by campus planners which related to desirable rehabilitation of buildings were more fundamental: (1) some buildings built as late as the 1940's do not meet current standards for wiring and fire resistance, and (2) a number of science laboratories need modernization. In some disciplines where research techniques were fast-moving, laboratory layouts had become obsolete. The need to modernize them is quite urgent.

After consolidating our notes of field visits, and applying the factors to facilities in all the public sector, we arrived at the conclusion that probably two per cent of the space in the public sector would require drastic refurbishing. Probably another two per cent will become obsolete by the end of the 1980's.

Our consultants estimated the cost of refurbishing buildings at $25 to $30 a square foot, or between 50 and 75 per cent of the cost of new construction. If these figures are accepted, some $800 million at current prices could be needed for major refurbishing. Some of this refurbishing may never take place, however, because older buildings may be demolished rather than refurbished.

In the private sector, the need for rehabilitation is less clear-cut. The average age of buildings is much higher than in the public sector. Also, a number of financially hard-pressed schools have greatly neglected maintenance. In some schools, roofs have been undermaintained, resulting in damage to the structures. Stories of bad plumbing and overage boilers in the heating plant are also commonplace. Painting, minor maintenance, and cleaning are generally at a lower standard than in the public sector.

Private sector space planners believe that some ten per cent of the value of the plant should be spent to bring it up to snuff, and that roughly one per cent a year from there on should be spent on renovations. We were rather surprised by the consistency of these estimates coming from space planners in what appeared to be both well- and under-maintained campuses. In fact, while the cited backlogs are of the same magnitude, the objectives for refurbishing differed. The space planner from the under-maintained campus cited as his priorities heating, roofing, and painting. The priorities on the well-maintained campus were mostly in the area of remodeling. In the opinion of the administration and faculty, classroom buildings needed remodeling to provide additional office, research, and specialized library space. By our modest standards, there were no shortages of any kind of space on that campus, and considerable money would be saved in the long run by calling in the bulldozer rather than the architect.

Conclusion

During our field work, we saw little evidence that the drying up of federal funds affected construction decisions, except in the case of one medical school. Nor was there any evidence that shortages of funds affected the architectural plans of different schools. In certain instances, space planners complained about the slowness and inflexibility of state agencies in approving expenditures of funds. By contrast, federal facilities personnel received high marks for their understanding and cooperation in the past.

Despite the high regard for federal personnel in local planning circles, their influence on determining space standards was minimal. Also, the lip service given to planning educational facilities in a given area did not bring cooperative ventures into being, either in construction or operation of facilities, by different entities of public systems or between public and private schools.

TABLE 9.1

INDEXES OF CONSTRUCTION COSTS AND COST OF LIVING INDEX

(1957-59 = 100)

	College Management College Building Index	Department of Commerce Composite Index	BLS Cost of Living Index
1963	109.9	109	106.7
1964	112.6	112	108.1
1965	115.7	115	109.9
1966	119.6	119	113.1
1967	124.0	125	116.3
1968	130.6	131	121.2
1969	139.7	142	127.6
1970	149.7	152	135.2
1971	159.2	153	141.1
1972	168.8	164	145.7
1973	177.0*	177**	154.3**

* Estimated
** July

Source: College Management, June/July 1972; Department of Commerce and Bureau of Labor Statistics Cost of Living Indices: adapted from Statistical Abstract of the United States, 1972, and Survey of Current Business, Idem.

TABLE 9.2

INDEX OF FACILITIES COSTS BY TYPE

(Average Cost per Square Foot of Construction Projects Started in 1970-1971 by All Institutions of Higher Education in the U. S. = 100)

Instructional Functions	
Educational Laboratory	112
Fieldhouse Gymnasium	76
Instructional-Classroom	96
Instructional-Laboratory	102
Library	98
Teaching Hospital	152
Research Functions	
Agriculture	89
Astronomy	131
Biological	112
Chemistry	132
Math and Statistics	110
Physics	132
Other Physical Science	119
Social Sciences	102
Dentistry	157
Engineering	108
Medicine	141
General Functions	
Administrative Building	99
Auditorium	90
College Union	93
Food Facilities	99
Garage-Vehicles	26
Office Building	104
Theater	119

TABLE 9.2 (Cont'd)

INDEX OF FACILITIES COSTS BY TYPE

(Average Cost per Square Foot of Construction Projects
Started in 1970-1971 by All Institutions of Higher
Education in the U. S. = 100)

Residential Functions	
Married Student Apartments	75
Men's Residence Hall	77
Women's Residence Hall	68
Coed Residence Hall	83

Source: "1971 Index: Campus Construction Costs Continue to Rise," College Management, June 1971, p. 9.

TABLE 9.3

COST PER SQUARE FOOT OF COLLEGE CONSTRUCTION, BY REGION

	1972 Completed	1973 Completed	1973 Starts	Total 1972-1973
Region*	Cost Per Square Foot	Cost Per Square Foot	Cost Per Square Foot	Cost Per Square Foot
1	40.67	59.06	62.21	55.34
2	45.05	53.51	76.09	57.45
3	37.77	45.81	50.43	44.87
4	37.72	32.14	30.95	34.14
5	32.55	33.39	47.15	37.47
6	29.98	30.19	33.79	31.66
7	28.65	39.84	51.13	42.64
8	28.89	35.83	36.64	33.90
9	55.36	42.62	51.13	49.80
	39.03	43.36	52.22	45.26

*Regions are as follows:

Region 1

- Connecticut
- Maine
- Massachusetts
- New Hampshire
- Rhode Island
- Vermont

Region 2

- New Jersey
- New York
- Pennsylvania

Region 3

- Illinois
- Indiana
- Michigan
- Ohio
- Wisconsin

TABLE 9.3 (Cont'd)

COST PER SQUARE FOOT OF COLLEGE CONSTRUCTION, BY REGION

Region 4

Iowa
Kansas
Minnesota
Missouri
Nebraska
North Dakota
South Dakota

Region 5

Delaware
District of Columbia
Florida
Georgia
Maryland
North Carolina
South Carolina
Virginia
West Virginia

Region 6

Alabama
Kentucky
Mississippi
Tennessee

Region 7

Arkansas
Louisiana
Oklahoma
Texas

Region 8

Arizona
Colorado
Idaho
Montana
Nevada
New Mexico
Utah
Wyoming

Region 9

Alaska
California
Hawaii
Oregon
Washington

Source: 1973 Cost of Building Statistics, College Management, June/July, 1973

CHAPTER 10

NEW TECHNOLOGIES AND NEW ATTENDANCE PATTERNS

Projections of space requirements made on the basis of present instructional technologies or current attendance patterns can be criticized as being insufficiently imaginative, since they do not take into account the startling technological changes which have taken place since the middle of the twentieth century. Many educators have argued that the impact of television, learning machines, and computers is likely to revolutionize higher education, and that the universities of the twenty-first century will be unrecognizable to today's students and administrators. The most radical advocates of change have repeatedly questioned the necessity of bringing together large numbers of young people on campus, and have advocated decentralized, home-based learning centers, which will do away with the need for college campuses altogether.

After perusing a significant volume of literature on the subject of new technologies and new attendance patterns, we came away with a feeling of _deja vu_ about a large number of topics. The literature in the past 20 or 30 years is replete with announcements of brave new experiments which will revolutionize the post-secondary sector. The institutions in which these experiments were started ten or fifteen years ago are indistinguishable today from the stick-in-the-mud institutions which continued in their conventional way. Time and again, when the failure of an experiment is reviewed, the optimism for its success is not dampened, and hopes for one more technological breakthrough which will allow the technique to become operational are voiced.

Experiments to change drastically the form or content of post-secondary instruction, in our opinion, have floundered for two different reasons: (1) their applicability was limited, and (2) their costs were high. Most technological innovations were pioneered in rich institutions, with either foundation or government moneys. The attempts were directed to improving the course content and teaching techniques, rather than to reducing the cost of material. Thus, the institutions which had to watch their budgets did not participate in the development of new technologies and could not use them, while those which did had little regard for financial constraints.

In addition to these institutional rigidities, as long as development costs remain high for course materials using advanced technologies, such as computers, a number of other stumbling blocks are in the way of the acceptance of drastically different instructional technologies:

(1) There is no set national curriculum for post-secondary subjects. Different schools adapt course content to both their students and the whims of the instructor.

(2) The caliber of students between one school and the next is drastically different. Individualization of instruction may be successfully programmed for M.I.T. students, but will not satisfy students at N.Y.U. with S.A.T. scores 200 points lower than those at M.I.T.

(3) The priority for the presentation of material may change in disciplines subject to a knowledge explosion, or to fads in a discipline where fashions rather than the scope of knowledge determine the scope of the course work, and destroy the considerable investment which was required to prepare the course material for presentation with new technology.

Finally, most discussions of new technology ignore the function of post-secondary institutions as either socializing, or "aging-vats," or milieus for learning. Most technologists assume that it is sufficient to merely present the information covered in post-secondary courses in order to have it absorbed by the student. The reinforcement effect of living or communicating with other students is generally discounted.

It has been claimed that the lecture method, once popular in Greece, was reinvented during the Renaissance, when dissemination of knowledge on a larger scale became popular once again. In the absence of cheap materials, conversational instruction was an economic necessity. It is amazing that the invention of printing, and the distribution of cheap printed materials did nothing to reduce the popularity of the lecture method. Are new technologies, such as the computer, television, and the tape or video cassette so much more powerful than printed matter in breaking the educational system out of its traditional mold?

The Computer

The computer is a versatile tool with awe-inspiring potential. It has a number of uses in post-secondary education, some of them more likely than others. At the very outset, one ought to distinguish the role of the computer as (1) a device for computing or record-keeping, (2) a tool in the complex called "computer-assisted-instruction," and (3) as a manager of the learning process.

A Device for Computing or Record-Keeping. Besides the administrative functions performed by a computer for the non-academic function of the university, computers are used in both research and instruction. A large number of post-secondary institutions teach their students to use the computer in solving problems given as part of their course work. Generally, the laboratory space provided for both science and arts students includes a provision for a remote terminal, usually placed in the corner of a laboratory.

The computer at the other end of the terminal may be located in the given institution or at some remote location. With considerable economies of scale, the remote computer serving a number of campuses is likely to become the exception rather than the rule. If one were to assume 15 minutes of computer terminal usage per student per week (a rather generous estimate based upon the experience of a pioneering engineering school), with 50 hours a week availability, a terminal location of 50 square feet is needed for each 200 students. This is not enough space to worry about.

Computer-Assisted Instruction. Space for being taught by computer is another matter completely. It is conceivable that as many as four or five hours a week could be spent at a computer terminal by students participating in a heavily computerized program. Thus, as much as five square feet per FTE student could be required for that purpose.

Unfortunately, the prospects for CAI do not appear to be very promising. Wits have remarked that anything can be done with CAI at ten times the conventional cost. More serious analysts have had the following reservations:[1]

> "Computer-assisted learning: very poor, to date, as a replacement for textbooks or paper-programmed instruction for original learning of most material on a cost-benefit basis. Highly worthwhile, if the programs are well-developed, in allowing students to test their understanding of material or explore the effects of certain choices in a simulated world represented by a computer model."

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[1] John F. Rockart, "A Method for the Integrated Use of Learning Resources in Education," *The Journal of Higher Education*, Vol. XLIV, No. 4 (April 1973).

A promising development at the University of Illinois, called PLATO (programmed logic for automated teaching operations), which uses a sophisticated display and late model equipment, is said to deliver course material at the cost of $0.60 to $0.80 an hour, as nearly as we can deduce net of development costs. The effectiveness of this material versus conventional material on a per-hour basis is now being tested. Because of high fixed costs, the power of the computer, etc., the system will only be a success if it is adopted widely. If it is, to remain competitive, it will require higher utilization of computer stations, and will not require any more space than conventional instruction.

Currently, there is a great division of opinion about the future of computer-assisted instruction in institutional settings. All cost-conscious administrators are even less optimistic about the use of cable television for transmitting course material than they are about the use of CAI on the premises of post-secondary institutions. The cost of sophisticated terminals in the home is likely to remain prohibitive for at least the next decade, and possibly the next two decades. The slow inroads of cable television are unlikely to speed up development of such a terminal either.

Manager of the Learning Process. The computer has also been used as a device to schedule and retrieve audio-visual materials for use in other technology-supported learning situations. It has been used to locate the right tape or audio-visual cassette for the student. Sometimes a small process-control type computer has been used for that purpose, at other times this additional task has been performed by a powerful administrative or research computer. In neither case has the space for that purpose been significant. A time-shared, interactive, computer-controlled television system (TICCIT) is currently under development.

Audio Devices

Language laboratories and tape-recorded lectures have been around for a long time, and probably have reached the peak of their acceptance. Audio centers are found in four out of five campuses. They are usually small, and employ no more than five full-time-equivalent staff members.[1] Space requirements for them have been provided above. Schools with courses on cassettes, e.g., Michigan State University, where 3,000 cassette stations average 100 hours a week, still require the same amount of space.

Audio-Visual Devices

The use of audio-visual devices, be they television programs or audio-visual cassettes, appears to be much more widely discussed, especially since easily accessible video cassettes became technologically feasible a few years ago. The National Science Foundation is sponsoring a study of their utilization, and subsidizing part of the production cost of materials. It is too early to pre-judge the results of this experiment.

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[1] "Audiovisual: 1970-71," College Management, October 1970, pp. 12-13.

Up to now, though, instructional television has failed to catch on in post-secondary institutions. A lecture on film is deadly dull. Some of the best teachers are "cut down to size" by the television tube. The possibility of instant replay on a cassette may be less of an advantage than most persons believe, as the continuity of the exposition is destroyed. Unless special programming is developed, and the lecture process is adapted to the requirements of television, little progress is likely in that field.

The experience of pre-school educators, who expended over $2 million for "Sesame Street," has not been internalized by post-secondary institutions, who still put substance over presentation, and are hence out of step with the requirements of the new video technologies.

General Comments

The pre-conditions for automation in the industrial world are (1) uniformity of the quality of raw materials, and (2) long production runs. In a general way, the same pre-conditions must be met by educational institutions before they adapt new technologies for their use. As long as the level of ability of students is not differentiated and specified by developers of programs, replication of successes with programs developed in one institution will not occur in other locations. Second, in order to justify the high development costs of most programs using advanced technology, a general consensus must be reached about course content and the usefulness of a technology. Third, as institutions of higher education pride themselves on their differences, it will be much more difficult to arrive at a consensus on either of these two topics. This consensus will certainly not be established until both the costs and the effectiveness of the new technologies are indisputable. Much in the present climate of academic penury conspires against a revolution in teaching techniques. The easy supply of faculty, the increasing concerns of tenured faculty about the security of their jobs, and the probable slower growth in total enrollments are likely to retard the acceptance of even proven techniques. The groves of academe are unlikely to shed their leaves and sprout antennas and radar towers for computer data transmission in the near future, at least not in the next 10 to 15 years.

The exposition in this chapter that few drastic innovations are on the horizon reflect the current consensus. A Delphi study by the

National Center for Higher Education, Management Systems at WICHE, did not expect any major changes to occur before the end of the decade. The findings of the panel are reproduced in Table 10.1.

Nor can considerable succor for the advocates of change be obtained from recent surveys of the Carnegie Commission on Higher Education. In a curious, loosely structured compilation by Roger E. Levien, The Emerging Technology: Instructional Uses of the Computer in Higher Education,[1] the compiler regards CAI as an emerging technology, which will not gain wide acceptance until the end of the decade, since program development is still in its incipient stage. The cost benefit of the computer-aided instruction is certainly attractive, according to Levien, if (1) the projected costs decline as much as Levien forecasts, and (2) if program development costs are not excessive.

After completing this review, we became aware of a technical report, also sponsored by the Carnegie Commission on Higher Education.[2] This report substantially used the same materials as we did, and can be used to document some of our findings. For instance, our survey of innovative institutions did not uncover striking differences in space. Space usage is not even mentioned in the above cited discussion of innovative institutions. Findings about shortening the B.A. period, outside credit by examination and work experience, etc., document the slight impact of these innovations on the 2,500 post-secondary institutions.

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[1] McGraw-Hill Book Company, New York: 1972.

[2] Ann Hess, An Inventory of Academic Innovation and Reform, Carnegie Commission on Higher Education, Berkeley, California: 1973.

In summary, the general consensus of observers, both sympathetic and unsympathetic, is that innovation is unlikely to change the character of demand for space in the post-secondary sector. On the contrary, attempts to innovate will probably decline in the future as excess space becomes available. Some of the modest attempts to provide more flexibility to dispense post-secondary services through weaning the student from the campus are likely to be discontinued. Probably by 1990 the post-secondary sector will be no different than it is today.

TABLE 10.1

STRUCTURE OF EDUCATIONAL TECHNOLOGY

Change Statement	Likelihood	Impact	Expected Date of Change	% Responding Should Occur	Most Promoted By	Most Hindered By
Use of individualized instruction will increase	Moderate	Very High	1979	96	Student	Faculty
The use of TV, Computers, and new technologies in postsecondary instruction will increase	Very High	High	1979	97	Industry	Faculty
Variations in academic calendars will increase	Moderate	Low	1978	79	Student	Faculty
The emphasis in postsecondary education will be on techniques and processes for learning rather than subject matter	Very Low	Moderate	1982	69	Student	Faculty
Future physical facilities will be more flexible and versatile	High	Moderate	1980	97	State	Faculty
Fewer faculty members per student will be required for instructional activities (due to such factors as changing technology)	Low	Moderate	1981	64	State	Faculty

TABLE 10.1 (Cont'd)

STRUCTURE OF EDUCATIONAL TECHNOLOGY

Change Statement	Likelihood	Impact	Expected Date of Change	% Responding Should Occur	Most Promoted By	Most Hindered By
Postsecondary education facilities will be used more hours in the day and more days in the year	Very High	Moderate	1977	98	State	Faculty
Diminishing amounts will be spent for capital construction in larger postsecondary education institutions	High	Very Low	1977	80	State	Public Inst.

Source: Vaughn E. Huckfeldt, A Forecast of Changes in Postsecondary Education, Western Interstate Commission for Postsecondary Education, 1972.

CHAPTER 11

HOW MUCH SPACE IS REALLY NEEDED?

Introduction

There is no generally accepted method of determining the amount of space required to accommodate a stated number of full-time-equivalent students. The most obvious uncertainties surrounding estimates of required space were described in Chapter 4. Assumptions had to be made about the type of program to be offered, the type of supporting facilities, etc. These assumptions may change drastically as the character of students changes, and more students attend vocationally oriented programs. Chapter 4 also stressed that the amount of space depends not only on the mix between graduate and undergraduate students, but that institutions enrolling a higher-than-average proportion of full-time students will probably need more space than institutions with more part-time students. In Chapter 6, it was also pointed out that, at least in universities, the available non-residential space varies considerably from institution to institution, depending upon the emphasis on physical and biological sciences.

The extent of support facilities per FTE student also varies a great deal between institutions. We documented large variations in assignable space per full-time or full-time-equivalent student in library, office, and other non-residential space categories. To some extent, these variations were caused by the character of the institution. Schools with important research commitments accumulate large book collections. These collections take a great deal of space to house, and consequently the storage and study space in these schools has to be above average.

Variations in the amount of office space are less closely tied to the characteristics of the school. Again, research-oriented schools provide reasonably elaborate facilities for their faculty. By contrast, most junior colleges up to now have placed a low priority on facilities for the use of faculty. Some junior college administrators still believe that two-year college instructors do not require more space than high school teachers. These administrators are now in the minority. As more emphasis is placed on counseling, and the general drive to "professionalize" two-year college faculties gains strength, more elaborate facilities for junior college faculty are planned. We do not wish to pass judgment on the cost/effectiveness of this trend, but just note, in passing, that the research activity in most schools is trivial, yet office facilities, at their optimum, are fairly similar in research and non-research schools.

The variation in ancillary facilities is most pronounced, and the standards of what is adequate even more of a gray area. Some institutions, mostly private schools and large state universities, are practically self-contained enclaves offering, besides instruction, culture, shopping, food, and housing. Others, especially newly established state four- and two-year colleges, are no more than embryos of schools, with classrooms, laboratories, and inadequate office and library facilities, with ancillary buildings still in the planning stage. It is possible to argue that these schools should remain underdeveloped, from a facilities point of view, and be re-oriented to cater to the fast-growing numbers of episodic, non-degree, vocationally oriented students.

The estimates of probable demand for space in this study are not based upon any radical thoughts about the restructuring of college campuses. Our survey of innovative activity has convinced us that no drastic change is anticipated by either campus planners or administrators. Instead, we have tried to apply imaginatively the modest standards developed in this study to develop a series of alternative targets. These standards, it will be remembered, are based upon existing practices. Implicitly, they also assume some upgrading in junior college facilities, and provide for facilities equal to those of similarly situated students in four-year schools. The standards reflect the consensus about what modest but adequate facilities ought to be.

As a general rule, the standards provide for less space than the average available in most institutions today. This discrepancy may be due to two causes: (1) the standards do not make any allowances for specialized facilities in medical schools and certain technological, agricultural, or scientific programs, and (2) actual availability of space reflects the recent overbuilding of some campuses, which were planned for higher enrollments than those which actually materialized. Since campus building is not divisible, campuses are built for the potential estimated enrollment, rather than the enrollment which is recorded the year new construction is completed.

Factors derived from data in the Appendix to Chapter 5 leads us to believe that space required for technological programs may add some nine per cent of the overall inventory. This figure is used in projections in Table 11.1.

It is also our conviction that very little, if any at all, additional space is required for the private sector. Undoubtedly, new buildings will be erected there. In some instances, administrators feel commited to a new building, e.g., a student union at Syracuse. In other instances, private schools receive large donations which allow them to improve their facilities, e.g., the grant from the Fairchild Corporation to build a science tower at Columbia University to imitate the Cummings tower at the University of Chicago. In other words, we believe that construction will continue in the private sector because most private institutions will build as much as they can afford.

A much more interesting question, from the point of view of policy, is the extent to which some of the excess space in the private sector can be transferred to the public sector. Some of these transfers are already happening, as the uptown New York University campus and the Brooklyn facilities of Long Island University have been sold to the City system. Other schools, especially private junior colleges, have large excesses of space by most standards, and it is quite possible that some of the space could be acquired by the public institutions, either by absorbing private schools, just as the University of Buffalo or the Upstate Medical Center in New York were absorbed by the State system, or through purchase of excess space from institutions. Estimates of future space requirements for the public sector, to which the rest of this chapter is devoted, will not take into account these transfers, since there is no way to forecast this trend objectively.

We shall now turn to a discussion of possible methodologies which could be used to estimate space needs in the public sector.

Methodologies

The most common methodology (and the most unsatisfactory one) is to multiply the space standards by the number of full-time-equivalent students. It assumes that if enough space is available to meet standards, available space is adequate, and variations of assignable square feet per student are due to program differences. Space standards multiplied by FTE students would provide a reasonable estimate of space only on condition that no excess space existed in any institution. With excess space in any one institution, shortages must exist somewhere else. Because the methodology is widely used, it is discussed below.

A somewhat more reasonable way of reckoning future space needs is to estimate the amount of space required to accommodate additional students who will be attending public institutions. This method assumes that existing space in 1970/71 was, on the average, adequate (which it was), and that additional construction will be channeled to eliminate shortages, and schools with surplus space will recruit students to fill the available spaces. Despite the fact that these assumptions are somewhat optimistic, they are not unwarranted, and an estimate reflecting them is also shown below.

By far the most reasonable estimate requires more complex calculations. To provide adequate space for all students, it is incumbent first to eliminate shortages in schools which are currently short of space; and second, to provide space for increased enrollments. Some of the space for additional students is likely to be provided in schools with more space than the average, where presumably facilities in place were planned for larger enrollments. An estimate of required space using these postulates is presented below.

Finally, it can be argued, albeit not very convincingly, that space shortages will be eliminated only if the relative advantage of space-rich schools is allowed to continue in the future. Thus, in order to bring space-poor schools up to the standard, available space in all schools has to be increased.

A discussion of each one of these methodologies follows.

Sufficient Space to Meet Average Standards

By Fall 1971, the public sector already had 529 million assignable square feet in place. (There were roughly 504 million square feet in the Fall of 1970.) If a contingency of ten per cent of the overall inventory were placed on our standards, roughly 650 million square feet would be required at peak enrollments in 1980 if our high estimate of enrollment is accepted, and 540 million square feet if the low estimate is accepted. With construction continuing to contribute some 40 million square feet in the course of the next few years, it is likely that these targets will be easily met.

If this projection is used to determine demand for space, and construction contracted for since Fall 1971 (some 140 million assignable square feet, of which 95 to 105 million square feet will go to the public sector) is added to the surviving stock, a shortage of space is impossible under the low projection, and is unlikely with the high projection of students, on condition that a modest number of building contracts continue to be let (see Table 11.2).

Providing Space for Additional Students

This is a very straightforward estimate. The increase in the number of FTE students in both the high and low enrollment projections are multiplied by the space standards. This exercise produces additional space requirements of between 90 and 195 million square feet by 1980/85. Again, given present construction rates, it does not seem that shortages in space will develop (see Table 11.3).

Eliminating Shortages and Building New Schools

The estimate to eliminate shortages was calculated as follows: all campuses in quartiles with space less than the standard were assumed to add space equal to the standard. For instance, if a group of public universities had less than 89.8 square feet per FTE student, the difference between the average space and 89.8 was multiplied by the number of FTE students to derive the space shortage. We estimated that the space shortage was 20 million assignable square feet (see Table 11.4), with the lion's share of it in other four-year schools. This amounts to less than four per cent of the available space.

In addition, with this methodology, space must be provided for universities, other four-year schools, and two-year schools to increase their size to accommodate new enrollments. Also, provision is made for a small number of new campuses to be established, in accordance with the assumptions stated in Chapter 3.

A table was constructed to calculate the additional space required for a school where enrollments would grow. It was assumed that, on the average, allowing for technical programs, eight per cent more space than in our standards ought to be made available in universities, five per cent in other four-year schools, and twelve per cent in two-year schools. Thus, a university with less than 10,000 FTE students likely to enroll between 10,000 and 20,000 FTE students by 1980 was assumed to require additional space to house the average number of FTE students enrolled in the larger category of school. The number of assignable square feet already available in the most space-rich schools was subtracted from the estimated space required. This method provided estimated requirements of between 89 to 193 million additional assignable square feet to accommodate FTE students by 1980 (see Table 11.4).

Increasing Average Space Proportionately

Although it may sound both unreasonable and wasteful, the possibility that average space should be increased proportionately for all schools in such a way that schools in the lowest quartile attain the minimum standard of space makes a great deal of sense in practice. Just as we have been unable to change drastically the income distribution of the population, and the reduction of the number of persons at the poverty level has been achieved only by raising everybody's income, it may also be impossible to allow schools with inadequate space to catch up to the admittedly modest standards without allowing the space-rich schools to increase their facilities as well. In other words, the estimates below give an indication of the extent of affluence needed to eliminate poverty in space.

These new "standards" have been derived by multiplying current averages of space by type of school by the ratio of the standard derived in this study by the actual space in the lowest quartile falling below the standard. The space in other quartiles was increased accordingly. For instance, if the space standard was 50 square feet, and the space in the lowest quartile was 25 square feet, it is presumed that adequate space standards in all space-poor schools would not be achieved until the space in all schools would double.

The space requirements using the above assumption are shown in Table 11.5.

Economies of Scale

We have been unable to find in the literature any consistent justification of larger amounts of space per full-time or full-time-equivalent student for smaller campuses. Perhaps small campuses are not planned, they just happen. Hence, there is little literature on their needs. Nevertheless, institutions catering to commuter populations in the public sector, as well as a number of smaller schools in the private sector, have existed for a very long time, and do perform reasonable, specialized functions to selected segments of students. In some cases, it appears reasonable to allow more space per pupil in a small institution because of the tradition of the school or the services it provides to a local community.

In the case of universities, once small divinity schools are eliminated, and research institutes such as the Rockefeller University or M.I.T. ignored, variations of available space per FTE student are not significant either in the public or private sectors. Among other four-year schools, both public and private, the differences in available space are quite striking. For instance, other four-year schools in the public sector with less than 2,500 enrollment have half again as much space as those in the 5,000 to 10,000 range. In the private sector, even wider discrepancies are registered.

Chart 11.1 shows the average square feet per FTE student for both other four-year schools and two-year schools. (We would suggest that the experience of small private junior colleges be ignored, since the space available there is not representative. Many of these schools are operating larger campuses than they want to, because their enrollments are declining.) If the slope of the two curves is averaged out, we would come to the conclusion that schools with less than 1,000 FTE students need roughly twice as much space, those between 1,000 and 2,500 FTE students about 50 per cent more space, and those between 2,500 and 5,000 FTE students some ten per cent more space.

The adjustment to space standards developed by this study for public institutions in 1980 appears in Table 11.6. The adjustment would vary slightly from year to year, because we have assumed a different distribution of institutions over the next 20 years. Because 1980 is the peak year for enrollment projections, it is reasonable to assume that, with present management techniques, some five to seven per cent more space than is provided by standards will be required in other four-year schools, and some 25 per cent more in two-year schools.

Available Space and Needed Future Commitments

The amount of total non-residential space which will be available in the period 1975 to 1990 was estimated in Chapter 7.

Below, we break down these estimates into space likely to be in use in the public and private sectors.

The starting point for the allocation was the inventory as of Fall 1971. At that time, 64.6 per cent of the non-residential space was accounted for by the public sector, and 35.4 per cent by the private sector. In the four years 1968 through 1971, the increment in the stock of non-residential facilities was 72 per cent to the public sector and 28 per cent to the private sector. We believe that this is a conservative estimate of the future increment of stock by sector. The proportion is more likely to be 85 per cent for the public sector and 15 per cent for the private sector, if the impressions gained from our field visits are to be trusted. Yet, in the interest of conservatism, we have adopted the 1968/71 experience. If we were to assume that an additional 36 million square feet of non-residential space would come onstream in 1975, to be added to the figures reproduced in Table 7.5 (a conservative estimate in the light of 1972/73 building starts), the total projected committed stock in the public sector, after providing generously for retirement, is likely to amount to the following:

1975	678 million assignable square feet
1980	664 " " " "
1985	649 " " " "
1990	622 " " " "

These figures include non-class laboratories, approximately 39 million assignable square feet.

Thus, the available non-residential space dealt with by this study, with no further starts, would be equal to 639 million square feet in 1975, declining to 627 million in 1980, 614 million in 1985, and 587 million in 1990.

If this study's standards, adjusted for technical programs and size of school were to be adopted, the required space requirements for the high projection would be met with current commitments through 1980, and would require only six million square feet of construction for the period 1980-1985. With no further construction, the system would have sufficient space through 1990.

Only under the assumption that present surpluses are allowed to persist, and space is provided for additional students with extra space allowances for technical standards and additional space for smaller schools, will the inventory be in balance in 1975 with the high enrollment projection. After that date, modest additional construction amounting to nine million square feet a year in 1975-80 would be sufficient to make up the future stock. Construction needs after that date would be equally modest.

If we were to use our preferred method of projection, that of eliminating shortages, as well as providing adequate space for new institutions, space already committed in the public sector would be sufficient to accommodate the low projection and leave 77 million square feet over, even after an allowance for an effective utilization for small schools. Additional availability of 14 million square feet per year during 1975-1980, about one-third the present rate, would be required during that period. The results of the various projections are summarized in Table 11.7.

Games Planners Can Play

Our survey of facility planning and existing facilities has convinced us that there are few hard and fast rules about necessary space for post-secondary students. We believe that certain minimum adequate standards can be derived, and we have done so in Chapter 4. After applying these standards to existing space in 1970, we came to the conclusion that shortages of space existed mostly in laboratory, office, and study space in some institutions.

Apparently these perceptions were shared by campus planners. The share of space added in these categories between 1968 and 1971 was far in excess of the store of space each type of use claimed during the earlier time period. Space in short supply was added to faster than space in other categories. This finding ought to give heart to those who believe in the rule of reason (see Table 11.8).

By contrast, the earlier conclusions of the Norris Committee, also supported by our study, that private four-year institutions already had a plethora of space, was not taken to heart. Non-residential space in every category of private schools was added to between 1968 and 1971.

One game which planners can play is to calculate how much space for public students can be made available by taking surplus space off the hands of the private sector. For instance, in 1970 the average private junior college student had 280 assignable square feet at his disposal. Generous standards would put the requirements at not much over half this figure. Given the space standards derived by our study, if half the private junior college space were reallocated or rented to public junior colleges, some 200 thousand additional FTE students could be accommodated.

Similar calculations about the amount of "stock" which could be transferred from the private to the public system could be made to estimate the extent to which the system could be challenged to absorb additional students in case enrollment projections turned out to be too low. As a matter of fact, since it will be difficult for schools to add to their staff if there is a sudden surge in enrollment, and the number of students accommodated depends on the ratio of staff to students, an even larger number of students could probably find places than simple averages would indicate.

To summarize, under most conceivable circumstances, the total space available for post-secondary students is, in the aggregate, adequate. To minimize future construction, transfers of space from the private to the public sector should be encouraged. Perhaps arrangements for joint use of space by public and private institutions could be encouraged and institutionalized.

The building boom, which reached its crest in real terms in the late 1960's, is already on the wane. The decline in construction levels is not likely to jeopardize admission opportunities for most students. If the low projections of enrollment describe future trends, it is most likely that after 1975 most institutions will only spend construction money to refurbish and modernize their plant.

And the Concerns of Space Experts

The large fluctuations of actual space available either per full-time or full-time-equivalent student in the U. S. post-secondary system makes it difficult to draw any conclusions about the possible redistribution of space from schools which have much too much space by all objective standards to other schools which have very little space. Most schools with excess space would not dream of sharing it with another institution. The comingling of classrooms, library and other facilities of a small liberal arts college with that of an open-enrollment junior college is abhorrent to most college presidents. We spoke about this possibility to three highly placed Administrators in institutions with declining enrollments, and met with little enthusiasm for our suggestion about sharing facilities.

The spinning off of part of a campus, especially if the campus is not too closely connected to the part of the space which is reduced, appears to be much more acceptable to private sector administrators. By contrast, public sector administrators are less happy to inherit "second-hand" facilities. The CUNY takeover of the New York University Uptown Campus was greatly resented by both the administration and faculty of the institution which was to be housed there. Not only had they been deprived of planning a new campus, but they also claimed that the classrooms in the N.Y.U. complex were too small to accommodate the large classes scheduled by the public institution. In that particular case, considerable pressure from the State Department of Education, concerned with N.Y.U.'s financial survival, was needed to have the City of New York agree to the takeover.

Without these pressures, it is quite likely that a number of campuses of failing schools, like Parsons College, will remain empty and will be razed. Our estimates of withdrawals space generally assume that for every college abandoned, one will be taken over. Thus, for instance, Nova College in Florida is very likely to become part of the state system, and some other school become the site of a housing development.

The real concerns of space planners are directed to three other topics: (1) to what extent can they accommodate unanticipated peak demand through renting, (2) how large will their exposure be to the needs of remodeling and refurbishing, and (3) how will space planning be affected by a surplus of space rather than a shortage.

There are no hard and fast answers to any of these questions. We already mentioned that renting is not likely to be a possible alternative for any but urban schools. The costs of renting, it was implied, were generally higher than those of building, and the facilities less satisfactory. Renting a vacant school, factory or office building is not likely to play an important role in providing available space.

The exposure to the needs for refurbishing and remodeling are a different matter indeed. To some extent they are related to the possibility that too much space will be available, and competition between schools for students will escalate. Buildings which have not acquired the patina of age which make them charming, and which have been indifferently maintained by slapping innumerable coats of cheap paint, are not likely to become beloved by students. Judging by the age of buildings, a fifth of the public sector inventory, and probably two-fifths of the private school inventory could benefit from cosmetic refurbishing. In addition to cosmetic refurbishing, the pressure to improve laboratory amenities may be quite high as schools compete for students. While the amount of space involved may not be large, the costs of this refurbishing estimated by heads of three large state systems at $40 a square foot, including equipment, may loom quite high.

What is really uncertain is how much of the space needs the ministering of the architect, and how much would be better off if it were bulldozed. In the absence of a national policy for training needs, no estimates can be made of what the refurbishing requirements might be. It should be pointed out, though, that the penury of the post-secondary sector, especially of private institutions, could only be marginally eased by subsidies or loans made on easy terms to renovate buildings.

By contrast, the possibility of a "space bank," with buildings to be purchased by the federal government and held till the need for them arises, would probably appeal to a large number of institutions. Unfortunately, since shortages are not on the horizon, this policy is unlikely to be implemented. Nor are alternative uses obvious for these buildings. In some cases, the classroom and laboratories could be used to house a regional high school, say one specializing in art, music or mathematics and science. Unfortunately, the idea of educational parks, with the concomitant divorce of students from their neighborhoods, has not caught on, and such uses are unlikely to be popular locally. Perhaps, a federal push to encourage them may be timely, if the idea of a space bank catches on.

Finally, a word may be appropriate about the impact of a plethora of space on the behaviour of institutions. Physical amenities may play a role in attracting students from one institution to another. Under these circumstances, the refurbishing of private institutions' plants to keep them competitive appears to make sense, if one wishes to maintain the diversity of the post-secondary system. Unfortunately, since the greatest disadvantage of the private sector is the high tuition which most of the schools must charge in the absence of state subsidies, small relief from capital refurbishing outlays will not erase their competitive disadvantage. It is difficult to envisage a federal policy, limited to facilities, which will redress the competitive balance between private and public schools. The federal role in the post-secondary sector must now concentrate on other issues, not bricks and mortar. It has been successful in the construction area in providing this country with a post-secondary plant second to none. As times change, so do concerns.

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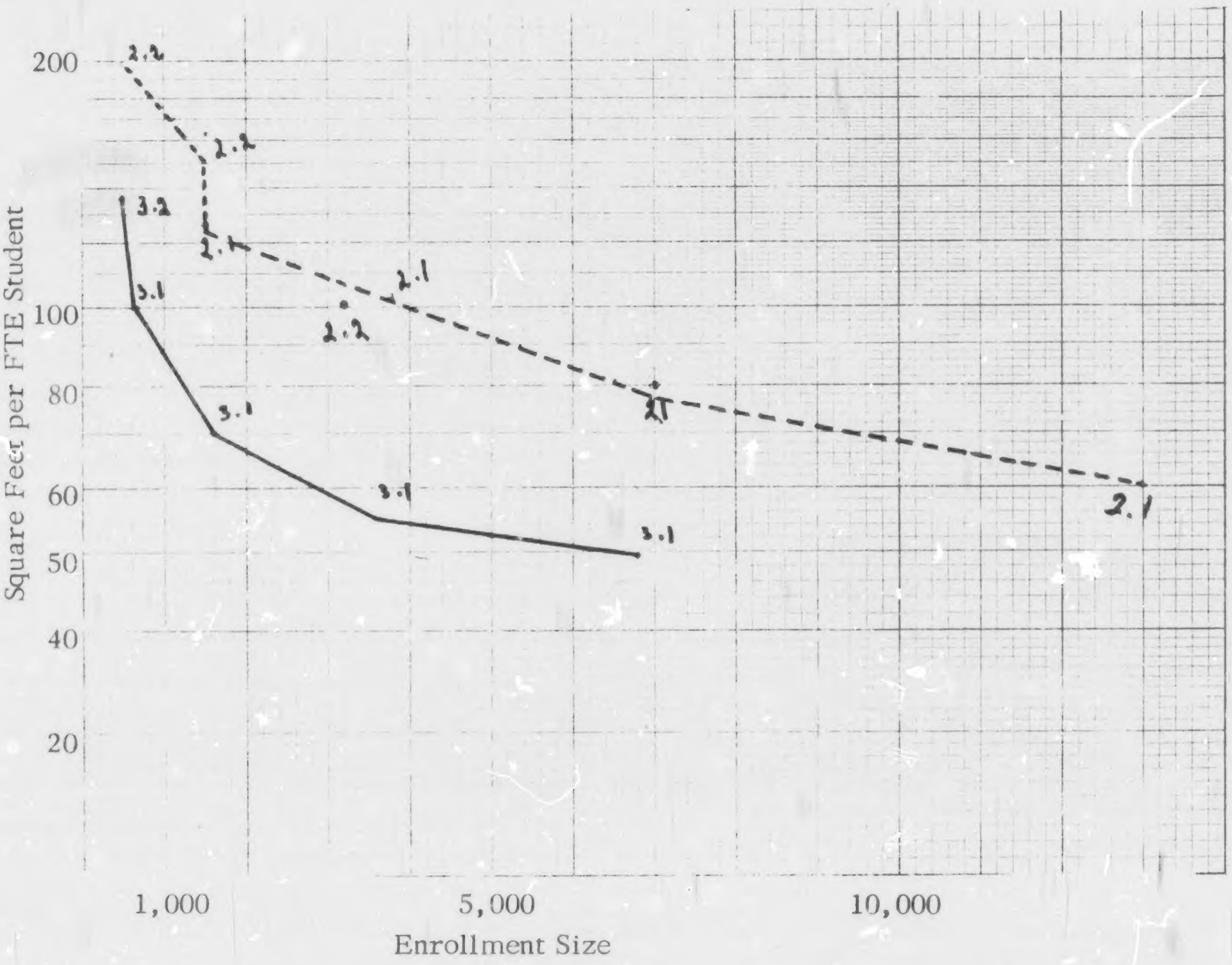
CHART 11.1

SQUARE FEET OF NON-RESIDENTIAL SPACE PER FTE STUDENT BY ENROLLMENT SIZE



2.1 Public Other Four-Year Schools
2.2 Private Other Four-Year Schools

3.1 Public Two-Year Schools
3.2 Private Two-Year Schools

TABLE 11.1

AVERAGE SPACE IN SCHOOLS IN PUBLIC SECTOR CAMPUSES WITH AND WITHOUT SPECIAL PROGRAMS

(Assignable Square Feet per FTE Student)

	All Schools, Including Those With Special Programs	Schools Without Special Programs	Space in Schools With Special Programs as Per Cent of Those Without
All	104	95	110
Universities	148	137	108
Other Four-Year Schools	82	78	105
Two-Year Schools	67	60	112

Source: HEGIS V.

TABLE 11.2

REQUIRED NON-RESIDENTIAL SPACE, BASED ON AVERAGE SPACE STANDARDS

(Thousands of Assignable Square Feet)

	1975		1980		1985		1990	
	Low	High	Low	High	Low	High	Low	High
Public Institutions								
Total	404,923	474,543	452,392	541,597	448,752	557,179	421,670	551,518
Universities	197,919	232,402	225,308	270,208	222,434	276,943	212,287	277,572
Other Four-Year Schools	120,097	140,603	129,992	155,374	138,739	172,080	126,766	165,842
Two-Year Schools	86,907	101,538	97,092	116,015	87,579	108,156	82,617	108,104
Private Institutions								
Total	184,921	216,690	168,484	202,032	158,465	197,128	140,609	184,267
Universities	71,211	83,709	65,906	79,346	63,430	79,111	56,592	74,159
Other Four-Year Schools	105,304	123,154	94,882	113,570	87,813	109,137	77,031	100,991
Two-Year Schools	8,406	9,827	7,696	9,116	7,222	8,880	6,986	9,117
Public and Private								
Total	589,844	691,233	620,876	743,629	607,217	754,307	562,279	735,785

Source: See text, p. 237.

TABLE 11.3

SPACE REQUIRED TO ACCOMMODATE ADDITIONAL PUBLIC SECTOR STUDENTS BY 1975, 1980, 1985, AND 1990

(Millions of Assignable Square Feet over Fall 1970 Inventory)

	1975		1980		1985		1990	
	Low	High	Low	High	Low	High	Low	High
Universities	11.5	46.0	38.8	83.8	36.0	90.5	25.8	91.1
Other Four-Year Schools	20.2	40.7	30.1	55.5	38.8	72.2	26.8	66.0
Two-Year Schools	10.7	25.1	20.7	39.6	11.2	31.7	6.2	31.7
Total	42.4	111.8	89.6	178.9	86.0	194.4	58.8	188.8

Source: See text, p. 237.

TABLE 11.4

SPACE REQUIRED TO ELIMINATE SHORTAGES AND PROVIDE FOR GROWING CAMPUSES, PUBLIC SECTOR

	1975		1980	
	Low	High	Low	High
Universities				
Shortages	4.9	4.9	4.9	4.9
New Campuses	8.6	26.3	55.0	141.0
Subtotal	13.5	31.2	59.9	145.9
Other Four-Year Schools				
Shortages	10.4	10.4	10.4	10.4
New Campuses	5.6	10.0	11.0	20.2
Subtotal	16.0	20.4	21.4	30.6
Two-Year Schools				
Shortages	5.6	5.6	5.6	5.6
New Campuses	4.2	9.8	6.2	11.1
Subtotal	9.8	15.4	11.8	16.7
Total Space Required	39.3	67.0	93.1	193.2

Source: See text, p. 237.

TABLE 11.5

PROJECTED MAXIMUM SPACE IN THE PUBLIC SECTOR TO KEEP THE "PECKING ORDER"

(Millions of Assignable Square Feet)

	1975		1980		1985		1990	
	Low	High	Low	High	Low	High	Low	High
Universities	335	393	381	457	377	468	359	470
Other Four-Year Schools	219	257	237	284	253	314	231	303
Two-Year Schools	201	236	225	269	203	251	192	251
Total	755	886	843	1,010	833	1,033	782	1,024

Source: See text, p. 240.

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TABLE 11.6

PER CENT OF ENROLLMENTS IN PUBLIC SECTOR SCHOOLS WITH FEWER THAN 5,000 FTE STUDENTS, AND ESTIMATED EFFECT ON SPACE REQUIREMENTS, 1980

	Per Cent of FTE Enrollment		Extra Space as Per Cent of Total Space	
	Low	High	Low	High
Other Four-Year Schools				
Less than 2,000	10	7	5	4
2,500 to 5,000	20	7	2	1
			7	5
Two-Year Schools				
Less than 1,000	7	6	7	6
1,000 to 2,500	34	25	17	13
2,500 to 5,000	25	37	3	4
			27	23

Source: HEGIS V.

TABLE 11.7

SUMMARY OF REQUIRED SPACE UNDER VARYING ASSUMPTIONS AND AVAILABLE SPACE, PUBLIC SECTOR, 1975 TO 1990

(Millions of Assignable Square Feet)

		1975		1980		1985		1990	
	I Based on Study Standards	Low	High	Low	High	Low	High	Low	High
		Enrollment Assumptions							
(1)	Study standards	404.9	494.5	452.4	541.6	448.8	557.2	421.7	551.5
(2)	(1), with additional space for technical programs	437.2	512.3	488.6	584.9	484.0	600.9	454.9	595.0
(3)	(2), and additional space for small schools	469.1	550.6	542.0	626.3	517.2	642.0	486.0	635.7
	II Present Space Plus Space for New Enrollments								
(4)	Space for new enrollments	45.7	121.3	97.4	194.9	93.1	211.4	63.7	113.7
(5)	(4), present space, space for new enrollments and technical programs	549.7	625.3	601.4	698.9	597.1	715.4	567.7	617.7
(6)	(5), including additional space for small schools	553.9	634.1	610.4	711.7	601.8	726.5	570.4	720.3

TABLE 11.7 (Cont'd.)

SUMMARY OF REQUIRED SPACE UNDER VARYING ASSUMPTIONS AND AVAILABLE SPACE, PUBLIC SECTOR, 1975 TO 1990

(Millions of Assignable Square Feet)

III Space Requirements Based on Present Space, Space Needed to Eliminate Shortages, and Provide for Technical Programs	1975		1980		1985		1990	
	Low	High	Low	High	Low	High	Low	High
			Enrollment Assumptions					
(7) Eliminate shortages, build new campuses, plus technical programs	543.3	571.0	593.1	697.2	n.a.	n.a.	n.a.	n.a.
(8) (7), plus size allowance	551.5	590.3	608.2	720.7	n.a.	n.a.	n.a.	n.a.
Available Space	639		627		614		587	

n.a.: Not applicable.

Source: See Chapter 11, p. 231.

TABLE 11.8

NON-RESIDENTIAL SPACE ADDED BETWEEN FALL 1968 AND FALL 1971

	Per Cent
Public Sector	72
Private Sector	28
Classroom	10
Laboratory	26
Study	11
Office	22

		Additional Space as Per Cent of 1968 Space
Total Space		57
Public Sector		68
Private Sector		41
Classrooms:	Public Sector	54
"	Private Sector	32
Laboratories:	Public Sector	81
"	Private Sector	58
Office:	Public Sector	93
"	Private Sector	64
Study:	Public Sector	77
"	Private Sector	64

Source: U. S. Department of Health, Education, and Welfare, Office of Education, National Center for Educational Statistics, Inventory of Physical Facilities, Institutions of Higher Education, Fall 1968, Government Printing Office, Washington, D.C., 1970, also, Fall 1971, Government Printing Office, Washington, D. C., 1973.

JOSEPH FROOMKIN INC.
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THE DEMAND FOR FACILITIES IN THE POST-SECONDARY SECTOR, 1975 TO 1990

APPENDIX

Contract OEC-0-72-5023

by

Joseph Froomkin
J. R. Endriss

With the Assistance of

Robert Stump
Karen Tammany

August 15, 1974

APPENDIX TO CHAPTER 5

ANALYSIS OF AVAILABLE SPACE BY TYPE OF SCHOOL

While the general analysis of space throws some light on how well institutions are endowed with different facilities, a better understanding of how the space is distributed may be garnered by discussing space availability institution by institution.

Public Universities

It will be remembered that public universities were divided into three size groups. The first size group contained all universities with less than 10,000 enrollment. In the case of full-time enrollment, this group covered 54 public university campuses. When full-time-equivalent enrollment cut-offs of 10,000 were set, the number of universities covered was 49. The second size group, with enrollments between 10,000 and 20,000 full-time or full-time-equivalent students, contained 58 universities when the full-time-equivalent students were used to estimate the cut-offs, and 43 when full-time students were used to calculate the group. The largest group, that of universities with over 20,000 enrollment, contained 22 universities with more than 20,000 FTE's, or 13 universities with more than 20,000 full-time students. Because part-time students do not play a very large role in those institutions, the available space calculated by either method did not vary too much. For instance, in the case of the smallest group, the total non-residential space for full-time students was 142 square feet. Similarly, in the smallest size group, it was 132 square feet for full-time-equivalent student. In the second group, the total non-residential space amounted to 126 square feet per full-time student, and 114 square feet per full-time-equivalent student. In the larger size group, the differences were equally small. Per full-time student, they were 154 square feet, and per full-time-equivalent student, 124 square feet.

The differences were much more pronounced when universities were grouped by quartile in ascending order of space. In the universities most poorly provided with space (with enrollments of less than 10,000), 82 square feet per full-time student were available. This figure declined to 74 square feet on an FTE basis. By contrast, those universities in the same size group most generously endowed with space (in the upper quartile of the distribution) had as much as 213 square feet per full-time student, and 132 square feet per FTE. The divergences were practically as large in the next size group (10,000 to 20,000 students). The space available was 84 square feet per full-time student, and 73 square feet when the group was arranged per FTE for institutions in the lowest quartile. The universities in the fourth quartile, by contrast, had 185 square feet per full-time student, and 164 square feet per FTE. The number of campuses in the larger-size group is too small to be broken down by quartiles, but even there the relationship between the universities with lots of space and those with little was equally wide.

In the case of class and laboratory space, the differences between space-rich and space-poor campuses was very much less pronounced. In the smaller university campuses, the difference in the availability of classroom space per full-time student between the lowest and the top quartile was on the order of 50 per cent. The greater disparities were in the available space in laboratories. There, practically three times more space was available in the better-provided institution as compared to those in the lowest quartile.

Variations in classroom space availability between the low and top was even less among the second-largest group. Roughly 11 square feet were available in the lowest quartile of the institutions, and some 14 square feet in the highest quartile. The lab space in the institutions with more space was not quite twice as much as it was in institutions with the least amount of space. On the basis of space standards, it appeared that the shortages in classrooms were probably felt in one-half of the institutions in the lowest quartile. When it came to lab space, given the rather generous standards adopted in Chapter 4, all the institutions in the lowest quartile were somewhat short of labs. The conclusions stated above are not changed at all by looking at full-time-equivalent enrollment statistics for these two kinds of space.

In the case of office space, the figures calculated on a per-student basis showed very wide variations within each size group. In the case of the smallest universities, when office space was calculated on a full-time-student basis, the variations were more than three to one between the best-endowed and the least-well-endowed college. In the second group, the ratio of office space per student in the top quartile was twice that in the bottom quartile. Quite significant variations in office space per full-time-equivalent student can also be inferred from the appropriate tables.

As we had occasion to point out, the measure of office space per either full-time or full-time-equivalent student is truly an approximate one and does not reflect the true needs of the institution. A better measure is the office space per total professional employed on a given campus. This figure appears at the bottom of Appendix Tables 5.1 to 5.3. The variations in space available measured this way are much narrower. The available office space per professional varies between 200 and 286 square feet in the smallest institutions, and between 200 and 276 square feet in the second group. It averages 290 square feet in the largest universities. Apparent shortages disappear because the available office space appears to be directly related to the staffing pattern of a given institution. From now on, only this measure will be mentioned in discussions of space in other institutions.

When it comes to study space, which includes stack space for the collections, reading rooms, and library administrative space, we can expect variations of some five or six square feet per FTE, because of the varying sizes of collections in different institutions. The actual variations, either on a full-time-equivalent or full-time basis, are just slightly larger than this amount in the smaller universities, and approximately six feet in the second size group. Under most conceivable circumstances, it seems likely that at least a quarter of the institutions do have shortages of study space. Either their collection is not housed as well as it ought to be, or, what is much more likely, if our field trips are at all representative, most institutions are short of seating space for students in libraries.

The largest variations were, of course, in the space for which there is no set of established standards. Thus, availability of special-use space per student varies in ratios of four to one among smaller universities. The variation is equally great whether one uses full-time or full-time-equivalent students to derive available space per student. As we have pointed out previously, the amount of space in that category depends a great deal on the commitment of the school to football. A lot of special use space is used in stadiums and athletic facilities. Under the circumstances, we feel again that probably there are shortages of space in the bottom quartile of small institutions, and possibly a less-pronounced shortage in institutions which are in the second size group. A small number of institutions in the larger size group also have very little special use space, less than ten square feet per full-time-equivalent student. Those are probably also candidates for additional facilities if it is believed important to improve their amenities.

In the case of general use space, the variations are wide, but not as wide - they are roughly two to one. Probably, again, only a quarter of the universities do not have sufficient general-use space to mount an impressive program of cultural activities.

We are less sanguine about commenting on the differences in support space. Some schools did not report any support space at all. Yet, the variations from the schools which did report it are still roughly two and a half or three to one, depending on how well the school is endowed with space.

A special note should be added here on the non-class lab space, namely that space which is put aside for special laboratories, most of them utilized in research. The variations from campus to campus in this type of space are truly astonishing. Generally, schools under 20,000 enrollment have, on the average, some 13 square feet per full-time student in this type of space. Yet, the variation between types of schools is startling. In the small size group, the schools in the lowest quartile have less than four square feet of research space, and those in the upper quartile have as much as 27 square feet. In the top size group, the variations are between less than six to more than 25. The largest schools, with over 20,000 enrollment, have an average of 26 square feet of lab space per full-time student. Roughly one-quarter of small university campuses have as strong a research commitment per student as do large state public university campuses.

Private Universities

There were 71 universities with 10,000 full-time students. When the 10,000 cut-off was applied to full-time-equivalent students, 69 of them still were in the same category. Ten universities reported information on both full-time and full-time-equivalent students, and are included in the next largest group. Only three universities had enrollments of over 20,000 students. All three, Brigham Young, Northeastern, and Boston, were probably better classified as liberal arts schools with graduate departments than universities. It is interesting to note that, while the total amount of non-residential space in private universities, on the average, exceeds considerably the same space in private schools, the lowest quartile in each size group is strikingly similar in both the public and private sectors. Thus, for universities with less than 10,000 enrollment in the lowest quartile of the space distribution, the difference between public and private campuses is less than seven square feet per full-time student, and less than four square feet per full-time-equivalent student. Private universities which have between 10,000 and 20,000 students enrolled and are in the lowest quartile of space availability only have six square feet more per full-time student than do the public universities. Coincidentally, these schools also appear to enroll a large number of part-time students.

The profile of space distribution between both public and private universities in the lowest quartile is strikingly similar. The total amount of class and lab space is within two square feet, either on a full-time or a full-time-equivalent basis. Generally, the private universities appear to offer even more restricted lab-oriented classes than do the public universities.

In the office space category, private schools do have somewhat more space per full-time-equivalent student or per full-time student than do the public schools. On the other hand, when the comparison is made for office space per full-time-equivalent professional, the private universities appear to have five per cent less space than do the public schools.

Quite striking similarities are also to be found in study space, special use space, and, to a lesser degree, general use space. Only in this last category, the private universities seem to be slightly better off than the publics. By contrast, they do appear to require somewhat less support space than the public institutions.

If we were to judge the research orientation of private campuses by the space pool of non-class lab space, one could conclude from them that they were not too different from those in the public sector. For private universities with little space in the 10,000 to 20,000 enrollment categories, there is similarity in the total available lab space between them and the public schools.

On the average, these schools also have the same amount of office space per full-time-equivalent professional as do the public schools. In the upper ranges of the space distribution, private universities with less than 20,000 enrollment had roughly twice as much non-class lab space as did the publics. Universities which were rich in other space also had as much as two to four times more space dedicated to research as the publics.

Public Four-Year Schools

The striking fact about public four-year campuses is that they are very much smaller than university campuses. In our sample, roughly 131 schools which reported space had enrollments of less than 2,500 students. Another 94 schools had enrollments of fewer than 5,000 students, but more than 2,500. Sixty-three schools were in the category of 5,000 to 10,000 students. Only 12 schools had enrollments of between 10,000 and 20,000 students.

Public four-year schools with enrollments of fewer than 2,500 students full-time generally devote about 40 per cent of their space to class and labs. On the average, schools in the lowest quartile of available space have low levels of availability of lab space, but compensate by having more classrooms to offer other programs. By contrast, schools in the second and third quartiles of the space distribution allocated 30 per cent of their space for classrooms. Strange results were recorded in the upper quartile of space. There, schools again allocated roughly 40 per cent of their total space to both class and labs. The average space in space-rich schools was four times as great on a full-time student basis as in a space-poor school. Actually, the situation was somewhat different if one looks at space availability on a full-time-equivalent basis. The schools in the upper quartile of space per student enrolled a large number of part-time students, and roughly half of their total enrollment was accounted for by part-timers, as contrasted to roughly 20 per cent in so-called space-poor schools. As a result, the difference of available class and lab space between the space-rich and the space-poor schools is much narrower; but space-rich schools still have two-and-a-half times as much space as the space-poor ones.

Office space in space-poor schools fared even worse than the space-poor public universities, though, on the average, the total space per full-time professional in all the small schools was only ten per cent less than it was in the universities. It will be noted that the second quartile of schools had as much space per full-time professional as the lowest quartile of the universities. The upper quartile had roughly the same amount of space as the upper quartile of the universities.

The greatest differences in space available between space-rich and space-poor liberal arts colleges occurred in study, special use, general use, and support space. In the case of study space, the lowest quartile schools had certainly inadequate facilities for study. They also had practically no special and general use space. In the upper quartile of space distribution, the public four-year schools had considerably more space than comparable public universities. As a matter of fact, they rivaled in the amount of space with the smaller private universities.

Public four-year schools with enrollments between 2,500 and 5,000 students had strikingly similar characteristics to the ones which were somewhat smaller. In general, the average amount of space in the lowest quartile for class and labs was about the same. Office space availability was again the same. The laboratory conditions were even worse in those schools than in the small schools, but the special use and general use space were somewhat more generously provided. The relationship of available class and lab space per full-time-equivalent student between the space-rich and the space-poor schools was one and a half to one, as contrasted to two and a half to one in the smaller schools, which leads us to the belief or conclusion that the smaller schools were not yet fully built up and did not reach their desired enrollments. Office space availabilities were in excess of 200 square feet per total professional in all categories except the first quartile.

When one looks at public four-year schools with 5,000 to 10,000 full-time enrollment, one is struck by the fact that they, too, are somewhat short of lab space. They are also as short of offices as the rest of the schools, and their other facilities are well below average, as well. The very large four-year schools are by far the poorest of the lot in terms of space. The lowest quartile barely meets the average standards for classrooms and labs on a full-time basis, although it is notable that the availability of labs seems to be more generous than in smaller schools. Office space in schools in the lowest quartiles is no different than in other four-year colleges. On the other hand, library facilities are the poorest yet, roughly one-half of the standard suggested in Chapter 4. Special use, general use, and support space are practically non-existent. They are much below the levels of even the lowest quartile of the public universities. For instance, in the universities, special use, general use, and support space amount to 24 square feet, even among space-poor schools. In public other four-year colleges, they amount to approximately 12 square feet.

Private Four-Year Schools

The majority of private four-year schools are extremely small. Some two-thirds of them have fewer than 1,000 full-time students enrolled. The proportion does not change much if one classifies the schools on the basis of full-time-equivalent students, either. As a general rule, the small schools, those with less than 1,000 enrollment, appear to have sufficient space in all categories, with the possible exception of office space, where they provide only 180 square feet per full-time professional. This is ten per cent more than what is available in the lowest quartile of public schools; however, it still may be somewhat inadequate.

More should be said about schools with between 1,000 and 2,500 full-time enrollment. These schools are roughly comparable in size to public schools with less than 2,500 enrollment. Here, the possible space shortages may occur either in labs or study space. The square feet available per total professional staff member, 189 square feet, is fairly close to the standard, and is within the level of tolerance of the error in our standards.

Private four-year schools between 2,500 and 5,000 full-time-equivalent students have roughly the enrollment of schools in that category in the public sector. They are deficient in lab space. However, they have sufficient classroom space to compensate for this deficiency in lab space, provided one is satisfied with the present structure of their programs.

The two private schools with enrollments over 5,000 also appear to be weak in terms of their lab space. There do not seem to be any other shortages which are apparent in those schools.

Public Two-Year Schools

Public two-year schools have been divided into four size categories: those enrolling under 1,000 students, those enrolling between 1,000 and 2,500 students, those enrolling between 2,500 and 5,000 students, and those enrolling over 5,000 students.

Only schools with between 1,000 and 2,500 enrollment are short of direct instructional space, i.e., classrooms and labs. Other schools seem to be fairly generously endowed with that space. Since so many of the junior colleges have been established recently, the square footage available for students in the third and fourth quartile must probably be taken with a grain of salt. This is not the planned space per student, and the high figures recorded are due to the fact that the colleges are still quite new, and have not yet reached their programmed levels of enrollment. In this context, by comparing the space available in smaller and larger institutions, one gets the impression that, while study, special use, and general use space seem to be fairly adequate in at least three quarters of the public junior colleges with enrollments under 1,000 full-time students and in half of the junior colleges with enrollments under 2,500 students, study space appears to be in short supply in all schools over 2,500 full-time enrollment, as is all non-instructional type of space.

With the exception of faculty members in the fourth quartile of schools with less than 1,000 enrollment, all the faculty and the professional staff in junior colleges seem to be meagerly provided with office space. In no case does office space exceed 210 square feet, with the exception of the upper quartile of the small schools. In the lowest quartile of all schools with enrollments under 5,000 full-time-students, the professional staff has under 185 square feet, sometimes as little as 100 square feet per full-time professional. These facilities are similar to those in high schools, rather than to those in the rest of the colleges.

Private Two-Year Schools

Private two-year colleges, with the exception of two which have over 2,500 full-time-equivalent enrollment, are extremely small. Thus, only 11 of them have over 1,000 students, and the major proportion, some 170 campuses which reported this space to HEGIS, have less than 1,000 full-time-equivalent enrollment. With the exception of a few schools in the 1,000 to 2,500 category, it appears there is a sufficient amount of space for most activities in those schools, with the possible exception of office space for faculty, which is poorly provided in the lowest quartile of the small schools.

It is truly remarkable that roughly half of the small private colleges have more space per full-time or full-time-equivalent student than universities. Probably it was not planned this way, but those are the schools which are suffering from large declines in enrollment as a result of the competition of the public two-year institutions. Hence, the space in these schools which is considered excess cannot be considered useful space unless many of those institutions are taken over by public authorities.

There are two fairly large private two-year schools. They appear to offer very few facilities for technical courses, and certainly skimp a great deal on all other amenities, be they office, library, or any other type of space. Most of the non-instructional space is in the general use category, apparently used for a variety of purposes, including classrooms, since otherwise it is rather unlikely that they could do with as little space as they have.

APPENDIX TABLE 5.1

AVERAGE SQUARE FEET PER FTE FOR SCHOOLS RANKED BY QUARTILE ON SELECTED CATEGORIES OF SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

A. Public Universities

		Less than 10,000 Enrollment					10,000 - 20,000 Enrollment					Over 20,000 Enrollment
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	Mean
Class:	FTE	6,135	7,127	6,570	6,462	6,590	14,180	15,378	15,702	14,647	14,966	28,293
	Sq. Ft.	7.08	11.29	15.11	20.17	13.55	7.62	9.46	10.85	13.82	10.55	9.40
Lab*:	FTE	6,650	6,390	6,993	6,276	6,570	15,225	15,219	15,417	14,127	14,966	28,293
	Sq. Ft.	8.58	15.99	20.72	32.20	19.64	9.76	13.03	16.80	23.76	16.11	14.40
Class + Lab*:	FTE	6,610	6,540	7,449	5,755	6,570	14,572	15,927	14,868	14,553	14,966	28,293
	Sq. Ft.	17.66	28.60	35.80	49.33	33.18	18.28	23.40	28.40	35.34	26.66	23.80
Office:	FTE	7,846	5,722	7,207	5,592	6,570	13,700	15,024	15,274	15,752	14,966	28,293
	Sq. Ft.	14.09	20.77	26.22	43.02	26.37	15.00	20.00	25.74	33.96	24.03	28.74
Study:	FTE	7,192	6,749	7,406	5,609	6,706	15,393	14,303	14,811	15,306	14,966	28,293
	Sq. Ft.	5.69	9.96	11.97	18.17	11.71	5.45	7.92	10.90	14.70	9.92	10.45
General Use:	FTE	7,127	5,816	7,416	6,516	6,706	15,028	14,544	15,172	15,098	14,966	28,293
	Sq. Ft.	7.37	15.64	22.09	31.89	19.76	7.73	11.42	14.17	22.48	14.24	13.22
Special Use:	FTE	6,696	6,473	6,977	7,067	8,814	14,255	15,539	16,239	13,972	14,966	28,293
	Sq. Ft.	4.24	10.51	19.83	36.97	18.87	5.73	10.01	14.46	17.54	14.89	13.75
Support:	FTE	7,186	6,813	6,593	6,852	6,847	14,675	15,758	13,876	15,479	14,966	28,293
	Sq. Ft.	4.56	8.68	11.04	18.09	11.01	4.33	7.14	12.03	23.60	12.18	13.36
Total Non-Residential Space:	FTE	7,421	6,662	5,960	6,267	6,570	14,482	15,244	14,985	15,128	14,966	28,293
	Sq. Ft.	73.63	112.53	146.78	188.91	131.65	73.07	95.41	117.77	163.55	114.21	124.48
Residential Space:	FTE	6,673	7,356	6,739	6,819	6,921	15,007	15,348	15,020	14,826	15,044	28,293
	Sq. Ft.	14.32	57.17	86.16	114.84	75.30	16.13	46.50	72.95	91.02	60.11	51.45

* Excluding labs used for research only.

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APPENDIX TABLE 5.1 (Cont'd)

AVERAGE SQUARE FEET PER FTE FOR SCHOOLS RANKED BY QUARTILE ON SELECTED CATEGORIES OF SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

B. Private Universities

		Less than 10,000 Enrollment					10,000 - 20,000 Enrollment	Over 20,000 Enrollment
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	Mean	Mean
Class:	FTE	5,482	5,616	3,805	2,680	4,354	13,778	22,892
	Sq. Ft.	10.99	14.74	20.06	30.36	19.32	14.65	8.94
Lab*:	FTE	5,179	5,218	4,304	3,413	4,487	13,778	22,892
	Sq. Ft.	5.91	11.20	18.36	31.32	17.41	13.39	9.59
Class + Lab*:	FTE	6,139	4,542	3,969	2,954	4,354	13,778	22,892
	Sq. Ft.	19.74	28.59	38.32	56.10	36.22	28.04	18.53
Office:	FTE	6,073	3,924	4,513	2,748	4,292	13,778	22,892
	Sq. Ft.	15.05	23.49	33.16	70.79	36.13	36.21	17.76
Study:	FTE	5,465	5,016	4,305	2,486	4,292	13,778	22,892
	Sq. Ft.	6.23	13.14	23.16	43.94	21.94	23.39	6.57
General Use:	FTE	6,258	4,441	4,093	2,827	4,354	13,778	22,872
	Sq. Ft.	9.69	18.25	31.05	66.86	32.30	19.73	8.11
Special Use:	FTE	5,517	4,468	4,329	3,956	4,500	13,778	22,892
	Sq. Ft.	5.43	10.65	17.98	40.64	19.83	11.59	8.13
Support:	FTE	4,916	4,813	4,704	2,820	4,292	13,778	
	Sq. Ft.	3.31	8.32	14.02	42.41	17.39	16.96	
Total Non-Residential Space:	FTE	6,171	4,154	3,640	3,261	4,292	13,778	22,892
	Sq. Ft.	77.14	126.13	168.54	343.16	181.13	161.40	73.12
Residential Space:	FTE	6,038	4,926	4,187	2,781	4,411	13,778	
	Sq. Ft.	20.79	60.84	94.51	185.94	94.02	68.31	

* Excluding labs used for research only.

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APPENDIX TABLE 5.1 (Cont'd)

AVERAGE SQUARE FEET PER FTE FOR SCHOOLS RANKED BY QUARTILE ON SELECTED CATEGORIES OF SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

C. Public Other Four-Year Schools

		Less than 2,500 Enrollment					2,500 - 5,000 Enrollment				
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Class:	FTE	1,634	1,662	1,391	1,283	1,489	3,467	3,786	3,964	3,502	3,676
	Sq. Ft.	9.27	14.43	19.15	27.43	17.74	8.24	11.88	14.53	21.75	14.26
Lab*:	FTE	1,515	1,428	1,641	1,608	1,551	3,515	3,532	3,943	3,711	3,676
	Sq. Ft.	5.95	12.87	18.76	31.48	18.16	7.14	11.69	15.80	23.70	14.78
Class + Lab*:	FTE	1,413	1,534	1,629	1,385	1,489	3,490	3,728	3,849	3,639	3,676
	Sq. Ft.	17.80	28.35	38.13	54.11	34.94	16.68	25.06	30.93	42.34	29.04
Office:	FTE	1,395	1,683	1,571	1,317	1,489	3,393	3,585	3,748	3,954	3,676
	Sq. Ft.	8.35	13.33	16.98	26.46	16.46	8.41	12.27	15.68	20.54	14.44
Study:	FTE	1,672	1,573	1,540	1,304	1,515	3,607	3,727	3,769	3,607	3,676
	Sq. Ft.	4.59	8.59	12.89	23.61	12.83	4.09	7.43	10.54	15.08	9.41
General Use:	FTE	1,502	1,653	1,642	1,340	1,532	3,514	3,776	3,674	3,768	3,687
	Sq. Ft.	5.48	14.25	23.90	[illegible]	22.90	7.10	13.20	20.10	29.19	17.76
Special Use:	FTE	1,505	1,623	1,645	1,464	1,564	3,452	3,661	3,677	3,914	3,688
	Sq. Ft.	0.46	10.09	18.04	34.04	17.80	4.00	8.91	14.68	27.97	14.52
Support:	FTE	1,611	1,339	1,632	1,567	1,535	3,550	3,680	3,687	3,779	3,676
	Sq. Ft.	1.68	4.74	8.89	17.34	8.63	2.13	4.40	7.50	13.70	7.08
Total Non-Residential Space:	FTE	1,474	1,522	1,630	1,339	1,489	3,459	3,800	3,589	3,842	3,676
	Sq. Ft.	50.84	90.72	129.10	168.78	110.89	53.02	81.21	99.93	132.59	92.56
Residential Space:	FTE		1,603	1,610	1,471	1,558	3,535	3,903	3,659	3,732	3,743
	Sq. Ft.		25.26	60.26	126.43	75.06	11.55	34.44	67.07	106.36	65.06

* Excluding labs used for research only.

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APPENDIX TABLE 5.1 (Cont'd)

AVERAGE SQUARE FEET PER FTE FOR SCHOOLS RANKED BY QUARTILE ON SELECTED CATEGORIES OF SPACE PER FULL-TIME-EQUIVALENT-STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

C. Public Other Four-Year Schools (Cont'd)

		5,000 - 10,000 Enrollment					Over 10,000 Enrollment
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	Mean
Class:	FTE	7,113	6,764	7,111	7,214	7,051	13,787
	Sq. Ft.	6.84	9.33	11.78	16.83	11.19	8.62
Lab*:	FTE	7,228	7,197	7,255	6,523	7,051	13,787
	Sq. Ft.	6.54	11.57	14.39	20.74	13.31	12.30
Class + Lab*:	FTE	7,181	7,317	6,809	6,896	7,051	13,787
	Sq. Ft.	14.56	21.44	27.19	34.82	24.50	20.92
Office:	FTE	6,799	7,123	7,084	7,197	7,051	13,787
	Sq. Ft.	8.26	11.26	14.12	19.51	13.29	12.12
Study:	FTE	7,040	7,005	7,226	6,932	7,051	13.787
	Sq. Ft.	3.85	5.81	7.75	12.33	7.44	6.31
General Use:	FTE	6,691	7,695	6,989	6,827	7,051	13,787
	Sq. Ft.	6.25	11.95	16.58	21.51	14.08	6.45
Special Use:	FTE	7,038	7,651	6,781	6,732	7,051	13,787
	Sq. Ft.	5.02	9.87	14.74	26.29	13.98	7.03
Support:	FTE	7,365	6,743	7,585	6,509	7,051	13.787
	Sq. Ft.	1.58	3.66	6.10	11.39	5.68	5.55
Total Non-Residential Space:	FTE	7,129	7,433	6,857	6,784	7,051	13,787
	Sq. Ft.	48.10	72.09	88.06	111.88	80.03	59.51
Residential Space:	FTE	7,221	6,954	6,964	71.95	7,071	
	Sq. Ft.	8.81	35.81	62.80	95.38	54.51	

* Excluding labs used for research only

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APPENDIX TABLE 5.1 (Cont'd)

AVERAGE SQUARE FEET PER FTE FOR SCHOOLS RANKED BY QUARTILE ON SELECTED CATEGORIES OF SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

D. Private Other Four-Year Schools

		Less than 1,000 Enrollment					1,000 - 2,500 Enrollment				
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Class:	FTE	627	609	641	505	595	1,545	1,571	1,473	1,419	1,502
	Sq. Ft.	14.17	22.29	29.15	44.08	27.55	11.92	17.41	21.77	33.20	21.16
Lab*:	FTE	534	620	628	632	609	1,547	1,522	1,452	1,480	1,500
	Sq. Ft.	5.56	14.65	23.80	42.11	22.89	7.73	15.63	21.58	34.73	20.11
Class + Lab*:	FTE	566	597	656	559	594	1,586	1,507	1,456	1,458	1,502
	Sq. Ft.	23.20	39.81	53.70	77.60	48.76	22.20	34.62	43.61	63.45	41.13
Office:	FTE	554	641	534	540	594	1,559	1,516	1,470	1,463	1,502
	Sq. Ft.	10.55	19.56	25.64	36.57	21.58	12.16	18.36	22.75	32.72	21.58
Study:	FTE	615	598	606	568	576	1,525	1,507	1,567	1,409	1,502
	Sq. Ft.	7.53	14.71	21.66	40.42	21.32	6.84	12.29	17.39	29.84	16.68
General Use:	FTE	571	635	604	577	597	1,635	1,490	1,517	1,376	1,503
	Sq. Ft.	14.91	36.55	52.69	69.05	48.84	14.70	29.40	40.39	65.07	37.67
Special Use:	FTE	567	646	642	639	632	1,549	1,521	1,502	1,447	1,503
	Sq. Ft.	2.00	11.44	22.90	49.70	24.67	5.89	14.62	23.03	41.83	21.76
Support:	FTE	583	652	608	582	608	1,539	1,455	1,487	1,528	1,502
	Sq. Ft.	1.71	6.73	14.77	58.26	16.67	2.30	7.01	13.41	32.38	14.03
Total Non-Residential Space:	FTE	545	623	652	558	594	1,609	1,480	1,462	1,456	1,502
	Sq. Ft.	83.96	150.56	196.11	283.65	179.23	79.39	130.48	164.75	238.04	153.77
Residential Space:	FTE	616	632	638	558	610	1,619	1,519	1,451	1,441	1,503
	Sq. Ft.	42.52	92.82	132.37	225.57	132.82	45.54	86.53	112.62	177.19	108.43

* Excluding labs used for research only.

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APPENDIX TABLE 5.1 (Cont'd)

AVERAGE SQUARE FEET PER FTE FOR SCHOOLS RANKED BY QUARTILE ON SELECTED CATEGORIES OF SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

D. Private Other Four-Year Schools (Cont'd)

		2,500 - 5,000 Enrollment					Over 5,000 Enrollment
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	Mean
Class:	FTE	3,475	3,009	3,760	2,832	3,249	6,065
	Sq. Ft.	9.09	12.51	15.29	20.51	14.62	12.73
Lab*:	FTE	3,355	3,498	3,158	3,054	3,255	6,065
	Sq. Ft.	3.82	9.32	15.42	24.61	14.01	8.67
Class + Lab*:	FTE	3,422	3,395	3,268	2,966	3,249	6,065
	Sq. Ft.	14.39	21.87	30.46	43.75	28.32	21.40
Office:	FTE	3,355	3,510	3,097	3,070	3,249	5,065
	Sq. Ft.	9.43	13.61	16.17	24.83	16.39	13.29
Study:	FTE	3,472	3,539	3,298	2,776	3,249	6,065
	Sq. Ft.	5.11	8.42	12.07	21.17	12.11	8.11
General Use:	FTE	3,319	3,506	3,456	2,801	3,249	6,065
	Sq. Ft.	8.35	15.99	23.45	42.16	23.34	13.13
Special Use:	FTE	3,640	3,216	3,469	3,764	3,249	6,065
	Sq. Ft.	2.94	8.36	13.91	36.95	13.65	6.28
Support:	FTE	3,118	3,553	3,599	3,809	3,249	
	Sq. Ft.	1.42	3.89	6.88	16.00	7.43	
Total Non-Residential Space:	FTE	3,480	3,419	3,393	2,791	3,249	6,065
	Sq. Ft.	49.66	80.98	105.06	165.17	103.04	69.18
Residential Space:	FTE	3,719	3,178	3,124	3,078	3,237	
	Sq. Ft.	18.39	43.51	63.56	120.36	67.20	

* Excluding labs used for research only.

APPENDIX TABLE 5.1 (Cont'd)

AVERAGE SQUARE FEET PER FTE FOR SCHOOLS RANKED BY QUARTILE ON SELECTED CATEGORIES OF SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

E. Public Two-Year Schools

		Less than 1,000 Enrollment					1,000 - 2,500 Enrollment				
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Class:	FTE	658	624	592	491	590	1,834	1,582	1,535	1,542	1,622
	Sq. Ft.	9.25	14.45	20.80	36.57	20.48	6.24	10.06	13.89	23.12	13.42
Lab*:	FTE	585	611	597	596	598	1,745	1,680	1,613	1,470	1,625
	Sq. Ft.	6.97	15.67	25.50	42.29	23.22	5.46	11.87	19.83	35.64	18.42
Class + Lab*:	FTE	652	586	596	528	590	1,807	1,644	1,595	1,449	1,622
	Sq. Ft.	19.91	34.62	46.54	70.28	43.21	13.76	23.89	34.83	53.71	31.75
Office:	FTE	549	648	611	560	592	1,767	1,676	1,572	1,479	1,622
	Sq. Ft.	5.35	8.91	12.15	18.96	11.49	4.88	7.32	9.93	14.62	9.24
Study:	FTE	659	622	605	538	602	1,736	1,720	1,546	1,455	1,625
	Sq. Ft.	3.27	6.58	9.96	18.88	10.16	1.82	3.88	6.06	12.16	6.05
General Use:	FTE	628	621	588	578	602	1,755	1,608	1,572	1,494	1,623
	Sq. Ft.	2.58	6.63	11.88	26.36	12.55	2.02	4.49	9.63	19.67	9.08
Special Use:	FTE		578	680	579	614	1,784	1,686	1,661	1,440	1,620
	Sq. Ft.		1.81	15.29	32.28	17.49	0.20	2.79	9.76	20.82	9.73
Support:	FTE		677	625	641	647	1,658	1,733	1,559	1,519	1,612
	Sq. Ft.		0.66	2.52	10.42	4.77	0.31	1.16	3.01	12.22	4.69
Total Non-Residential Space:	FTE	613	591	596	558	589	1,813	1,684	568	1,432	1,622
	Sq. Ft.	41.26	72.68	99.91	151.63	92.01	28.70	51.97	75.49	117.52	68.87
Residential Space:	FTE				605	605			1,671	1,456	1,563
	Sq. Ft.				49.56	49.56			0.78	31.78	27.91

* Excluding labs used for research only.

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APPENDIX TABLE 5.1 (Cont'd)

AVERAGE SQUARE FEET PER FTE FOR SCHOOLS RANKED BY QUARTILE ON SELECTED CATEGORIES OF SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

E. Public Two-Year Schools (Cont'd)

		2,500 - 5,000 Enrollment					Over 5,000 Enrollment				
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Class:	FTE	3,568	3,699	3,643	3,521	3,607	7,794	8,368	7,890	6,630	7,689
	Sq. Ft.	5.65	7.73	9.74	15.51	9.71	5.37	6.67	8.32	14.77	8.67
Lab*:	FTE	3,435	3,531	3,968	3,498	3,607	8,481	8,306	7,178	6,723	7,689
	Sq. Ft.	5.41	11.22	15.82	26.43	14.82	7.51	11.74	15.04	21.90	13.90
Class + Lab*:	FTE	3,509	3,570	3,116	3,536	3,607	9,013	7,686	7,002	7,006	7,689
	Sq. Ft.	13.25	19.74	24.65	39.94	24.53	14.76	19.28	22.81	34.29	22.58
Office:	FTE	3,402	3,460	3,906	3,657	3,607	8,557	6,702	7,391	8,138	7,689
	Sq. Ft.	4.39	6.07	7.75	11.38	7.43	4.27	5.59	6.61	10.40	6.65
Study:	FTE	3,509	3,654	3,751	3,579	3,625	8,549	7,258	7,271	7,679	7,689
	Sq. Ft.	1.52	3.18	4.84	8.14	4.51	1.65	2.80	4.02	5.91	3.55
General Use:	FTE	3,528	3,608	3,626	3,604	3,607	8,330	7,602	7,610	7,179	7,689
	Sq. Ft.	2.47	4.92	7.67	12.62	6.97	2.65	4.74	6.14	9.17	5.61
Special Use:	FTE	3,595	3,753	3,672	3,484	3,625	6,209	9,447	7,954	7,107	7,689
	Sq. Ft.	1.25	5.36	8.28	12.20	6.97	2.29	5.15	6.69	9.24	5.78
Support:	FTE	3,606	3,572	3,906	3,449	3,633	7,542	8,698	7,104	7,393	7,689
	Sq. Ft.	0.58	1.36	2.57	5.49	2.62	0.60	1.94	3.10	6.63	3.00
Total Non-Residential Space:	FTE	3,442	3,836	3,637	3,517	3,607	8,891	7,329	7,667	6,808	7,689
	Sq. Ft.	28.01	44.22	55.74	81.86	52.72	32.37	41.21	48.50	68.24	47.20
Residential Space:	FTE				3,389	3,389				8,437	8,437
	Sq. Ft.				14.93	14.93				1.32	1.32

* Excluding labs used for research only.

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APPENDIX TABLE 5.1 (Cont'd)

AVERAGE SQUARE FEET PER FTE FOR SCHOOLS RANKED BY QUARTILE ON SELECTED CATEGORIES OF SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

F. Private Two-Year Schools

		Less than 1,000 Enrollment					1,000 - 2,500 Enrollment
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	Mean
Class:	FTE	438	453	350	263	375	322
	Sq. Ft.	13.51	21.51	29.20	51.16	29.11	14.65
Lab*:	FTE	417	384	360	351	375	1,385
	Sq. Ft.	4.36	10.17	17.95	34.41	17.89	8.63
Class + Lab*:	FTE	419	465	348	272	375	1,385
	Sq. Ft.	21.63	36.13	46.84	76.86	45.73	23.28
Office:	FTE	396	452	365	290	375	1,385
	Sq. Ft.	6.40	15.61	21.77	34.68	19.79	9.76
Study:	FTE	482	425	351	268	379	1,385
	Sq. Ft.	4.55	11.18	17.75	37.68	18.27	8.63
General Use:	FTE	436	430	372	278	377	1,385
	Sq. Ft.	6.55	27.43	48.66	84.98	43.06	18.66
Special Use:	FTE	315	416	475	283	388	1,335
	Sq. Ft.	0.18	5.02	24.88	66.11	32.04	11.77
Support:	FTE	323	409	467	315	391	1,371
	Sq. Ft.	0.60	3.43	11.71	35.39	16.16	9.03
Total Non-Residential Space:	FTE	455	426	355	269	375	1,385
	Sq. Ft.	59.20	127.46	176.26	285.93	163.67	77.44
Residential Space:	FTE	462	451	346	358	394	1,334
	Sq. Ft.	15.11	71.74	134.96	235.51	136.46	90.60

* Excluding labs used for research only.

APPENDIX TABLE 5.2

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

A. Public Universities

	Less than 10,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
FTE Enrollment	7,421	6,662	5,960	6,267	6,571
Class	10.22	13.43	14.25	16.09	13.55
Lab*	10.47	15.59	23.18	28.56	19.64
Class + Lab*	20.69	29.02	37.43	44.65	33.18
Office	15.79	23.90	28.72	36.25	26.37
Study	8.59	10.60	11.88	15.48	11.71
Special Use	7.01	15.41	22.75	29.48	18.88
General Use	10.16	18.68	25.25	24.94	19.76
Support	6.88	9.10	10.89	17.14	11.01
Total Non-Residential Space	73.63	112.53	146.78	188.91	131.66
Non-Class Lab	4.42	7.07	13.29	23.72	12.53
Office Space per Total Professional FT Staff	303.41	377.73	453.37	460.25	405.66
Office Space per Total Professional FTE Staff	257.15	316.85	373.28	391.92	340.53

*Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

A. Public Universities (Cont'd)

	10,000 - 20,000 Enrollment					Over 20,000 Enrollment
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	Mean
FTE Enrollment	14,482	15,244	14,985	15,128	14,966	28,294
Class	8.86	10.46	10.43	12.22	10.55	9.40
Lab*	11.92	15.43	14.67	21.64	16.11	14.40
Class + Lab*	20.78	25.88	25.10	33.87	26.66	23.80
Office	15.49	21.97	25.32	32.19	24.03	28.74
Study	6.58	9.29	12.47	11.15	9.92	10.45
Special Use	10.28	8.42	16.02	23.59	14.89	13.75
General Use	9.96	11.65	14.88	19.70	14.24	13.22
Support	7.09	10.42	11.42	18.86	12.19	13.36
Total Non-Residential Space	73.07	95.41	117.77	163.55	114.21	124.48
Non-Class Lab	2.88	7.75	12.39	23.00	11.90	19.05
Office Space per Total Professional FT Staff	313.46	429.10	487.63	508.93	429.09	461.04
Office Space per Total Professional FTE Staff	259.18	336.82	362.61	414.74	341.18	350.71

* Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

B. Private Universities

	Less than 10,000 Enrollment					10,000 - 20,000 Enrollment
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	Mean
FTE Enrollment	6,171	4,154	3,640	3,261	4,291	13,778
Class	13.44	15.97	21.48	26.39	19.42	14.65
Lab*	7.75	17.64	16.04	29.64	17.41	13.39
Class + Lab*	21.20	33.62	37.52	52.54	36.22	28.04
Office	19.66	24.71	34.66	63.87	36.13	36.21
Study	9.04	15.03	21.51	41.08	21.94	23.39
Special Use	7.76	14.25	21.32	35.03	19.83	11.59
General Use	12.41	23.41	32.69	60.67	32.30	19.73
Support	4.68	8.73	14.59	40.19	17.38	16.96
Total Non-Residential Space	77.14	126.13	168.54	343.16	181.13	161.40
Non-Class Lab	2.60	8.13	8.32	68.96	21.38	23.98
Office Space per Total Professional FT Staff	366.05	401.26	443.86	492.69	429.60	392.03
Office Space per Total Professional FTE Staff	250.60	337.38	390.87	423.02	355.64	304.51

* Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

C. Public Other Four-Year Schools

	Less than 2,500 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
FTE Enrollment	1,474	1,522	1,630	1,339	1,489
Class	12.19	15.95	18.41	23.97	17.74
Lab*	9.35	14.53	20.99	26.49	18.16
Class + Lab*	20.54	29.96	38.65	49.58	34.94
Office	10.73	14.82	17.28	22.57	16.46
Study	6.95	11.73	16.11	15.70	12.83
Special Use	3.91	13.14	19.79	30.04	17.80
General Use	6.97	16.73	25.49	38.77	22.90
Support	4.78	5.63	11.18	12.22	8.63
Total Non-Residential Space	50.84	90.72	129.10	168.78	110.89
Non-Class Lab	0.82	1.19	2.42	1.22	1.44
Office Space per Total Professional FT Staff	231.27	279.20	303.02	378.06	300.68
Office Space per Total Professional FTE Staff	210.58	260.92	291.81	356.16	282.83

* Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

C. Public Other Four-Year Schools (Cont'd)

	2,500 - 5,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
FTE Enrollment	3,459	3,800	3,589	3,842	3,676
Class	10.36	13.61	13.73	18.94	14.26
Lab*	9.13	15.45	15.28	18.89	14.78
Class + Lab*	19.49	29.06	29.01	37.83	29.04
Office	10.04	13.17	15.09	19.06	14.44
Study	5.64	9.31	10.51	11.96	9.41
Special Use	6.66	8.69	17.33	23.60	14.52
General Use	8.17	14.79	18.87	27.91	17.76
Support	3.78	5.36	8.24	10.62	7.08
Total Non-Residential Space	53.02	81.21	99.93	132.59	92.56
Non-Class Lab	0.65	0.95	1.01	1.81	1.15
Office Space per Total Professional FT Staff	205.55	262.94	294.42	322.28	274.45
Office Space per Total Professional FTE Staff	193.34	249.36	281.50	308.91	261.41

* Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

C. Public Other Four-Year Schools (Cont'd)

	5,000 - 10,000 Enrollment					Over 10,000 Enrollment
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	Mean
FTE Enrollment	7,129	7,433	6,857	6,784	7,051	13,787
Class	7.49	10.89	11.38	15.02	11.19	8.62
Lab*	7.47	12.91	14.73	18.14	13.31	12.30
Class + Lab*	14.95	23.80	26.11	33.16	24.50	20.92
Office	9.11	11.38	14.60	18.06	13.29	12.12
Study	5.49	6.41	8.55	9.29	7.44	6.31
Special Use	6.52	11.42	15.41	22.58	13.98	7.03
General Use	8.71	12.58	15.03	19.98	14.08	6.45
Support	2.58	5.73	7.18	7.24	5.68	5.55
Total Non-Residential Space	48.10	72.09	88.06	111.88	80.03	59.51
Non-Class Lab	1.00	0.86	1.31	1.56	1.20	1.13
Office Space per Total Professional FT Staff	191.42	245.04	285.48	344.63	267.43	249.61
Office Space per Total Professional FTE Staff	171.94	316.67	271.04	316.72	271.22	221.75

* Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

D. Private Other Four-Year Schools

	Less than 1,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
FTE Enrollment	545	623	652	558	594
Class	19.78	24.72	29.40	36.03	27.55
Lab*	9.93	18.58	25.56	34.27	22.89
Class + Lab*	27.29	42.67	54.53	70.02	48.76
Office	13.34	21.44	24.96	32.67	23.16
Study	12.16	16.55	22.40	33.66	21.32
Special Use	11.80	17.89	25.20	38.98	24.67
General Use	19.50	40.79	54.10	79.49	48.84
Support	5.44	12.79	17.06	28.64	16.67
Total Non-Residential Space	83.96	150.56	196.11	382.65	179.23
Non-Class Lab	0.94	2.41	1.49	3.03	2.25
Office Space per Total Professional FT Staff	349.69	334.52	360.03	430.07	369.03
Office Space per Total Professional FTE Staff	235.68	296.23	317.58	362.60	304.17

* Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

D. Private Other Four-Year Schools (Cont'd)

	1,000 - 2,500 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
FTE Enrollment	1,609	1,480	1,462	1,457	1,502
Class	14.95	19.09	22.90	27.53	21.16
Lab*	10.24	18.31	21.01	30.31	20.11
Class + Lab*	24.90	37.40	43.91	57.84	41.13
Office	14.12	19.82	21.76	30.36	21.58
Study	8.62	15.27	17.68	24.92	16.68
Special Use	9.37	17.28	23.84	35.30	21.77
General Use	17.85	30.16	41.38	60.35	37.67
Support	5.05	9.41	14.94	26.00	14.03
Total Non-Residential Space	79.39	130.48	164.76	238.04	153.77
Non-Class Lab	1.00	1.48	1.65	3.95	2.13
Office Space per Total Professional FT Staff	302.38	342.03	370.29	397.05	354.64
Office Space per Total Professional FTE Staff	254.08	313.75	341.88	368.08	321.55

* Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

D. Private Other Four-Year Schools (Cont'd)

	2,500 - 5,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
FTE Enrollment	3,480	3,419	3,393	2,791	3,249
Class	10.68	13.35	15.48	18.30	14.62
Lab*	5.08	10.04	16.35	22.25	14.01
Class + Lab*	15.29	23.38	31.83	40.56	28.32
Office	11.49	13.40	16.90	22.64	16.39
Study	6.56	10.34	11.58	18.74	12.11
Special Use	3.90	11.05	10.70	16.58	13.65
General Use	9.70	16.89	25.81	38.26	23.34
Support	2.32	5.00	5.88	15.14	7.43
Total Non-Residential Space	49.66	80.98	105.06	165.17	103.04
Non-Class Lab	0.71	1.12	2.58	3.16	2.18
Office Space per Total Professional FT Staff	306.12	279.66	325.47	335.33	313.07
Office Space per Total Professional FTE Staff	215.74	234.68	279.63	313.29	263.71

* Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

E. Public Two-Year Schools

	Less than 1,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
FTE Enrollment	613	591	596	558	589
Class	13.47	18.37	21.14	28.52	20.49
Lab*	10.52	19.25	25.85	36.15	23.22
Class + Lab*	23.52	37.34	46.62	64.18	43.21
Office	6.94	9.95	12.38	16.49	11.49
Study	5.19	8.24	11.08	15.53	10.16
Special Use	3.43	10.74	18.72	27.00	17.49
General Use	5.03	8.29	12.22	22.69	12.55
Support	2.21	2.70	4.01	8.26	4.77
Total Non-Residential Space	41.26	72.68	99.91	151.63	92.01
Non-Class Lab	--	5.51	0.71	1.68	1.68
Office Space per Total Professional FT Staff	178.09	202.79	253.45	310.75	237.81
Office Space per Total Professional FTE Staff	134.20	170.52	214.83	272.47	199.71

* Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

E. Public Two-Year Schools (Cont'd)

	1,000 - 2,500 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
FTE Enrollment	1,813	1,684	1,568	1,432	1,622
Class	7.67	12.01	15.08	18.70	13.42
Lab*	7.36	13.19	22.32	30.18	18.42
Class + Lab*	14.89	25.20	37.40	48.88	31.75
Office	5.79	7.86	10.05	13.11	9.24
Study	2.65	5.03	6.38	9.99	6.05
Special Use	1.86	7.08	9.59	17.55	9.73
General Use	3.01	6.14	8.92	17.90	9.09
Support	1.21	1.70	4.36	10.21	4.69
Total Non-Residential Space	28.70	51.97	75.49	117.52	68.87
Non-Class Lab	0.26	0.23	1.25	0.68	0.64
Office Space per Total Professional FT Staff	150.37	207.08	236.32	276.16	217.82
Office Space per Total Professional FTE Staff	117.88	167.93	204.82	248.07	185.07

* Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

E. Public Two-Year Schools (Cont'd)

	2,500 - 5,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
FTE Enrollment	3,442	3,836	3,637	3,517	3,607
Class	7.61	8.03	9.49	13.58	9.71
Lab*	6.32	12.37	15.03	25.19	14.82
Class + Lab*	13.93	20.40	24.52	38.77	24.53
Office	5.27	6.43	7.66	10.27	7.43
Study	2.46	3.39	5.09	6.86	4.51
Special Use	2.46	5.88	8.71	10.25	6.98
General Use	2.77	6.46	7.18	11.32	6.97
Support	1.55	1.82	2.55	4.42	2.62
Total Non-Residential Space	28.01	44.22	55.74	81.87	52.72
Non-Class Lab	0.10	0.11	0.08	0.16	0.16
Office Space per Total Professional FT Staff	136.67	178.15	232.10	237.45	196.39
Office Space per Total Professional FTE Staff	116.92	150.21	184.75	203.44	163.97

* Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

E. Public Two-Year Schools (Cont'd)

	Over 5,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
FTE Enrollment	8,891	7,329	7,667	6,808	7,689
Class	6.36	7.23	8.23	13.20	8.67
Lab*	9.55	11.82	14.25	20.46	13.90
Class + Lab*	15.91	19.05	22.48	33.66	22.58
Office	4.82	5.76	6.60	9.63	6.65
Study	2.38	3.43	3.89	4.58	3.55
Special Use	4.18	5.37	6.83	6.82	5.78
General Use	3.83	4.85	5.99	7.94	5.61
Support	1.24	2.70	2.67	5.59	3.00
Total Non-Residential Space	32.37	41.21	48.50	68.24	47.20
Non-Class Lab	0.09	0.06	0.22	0.16	0.14
Office Space per Total Professional FT Staff	153.15	200.80	207.36	277.35	212.92
Office Space per Total Professional FTE Staff	127.51	170.33	178.20	203.17	172.81

* Excluding labs used for research only.

APPENDIX TABLE 5.2 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time-Equivalent Student)

F. Private Two-Year Schools

	Less than 1,000 Enrollment					1,000 - 2.500 Enrollment
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	Mean
FTE Enrollment	455	426	355	269	375	1,385
Class	20.59	25.69	27.76	41.80	29.11	14.65
Lab*	8.06	14.44	19.78	26.65	17.89	8.63
Class + Lab*	27.12	38.75	47.54	68.45	45.74	23.28
Office	8.98	18.40	22.72	28.65	19.79	9.76
Study	8.26	14.46	18.68	30.75	18.27	8.63
Special Use	7.58	19.91	24.89	56.99	32.04	13.17
General Use	10.70	28.98	49.20	79.31	43.06	18.66
Support	4.03	12.32	18.23	24.70	16.16	9.03
Total Non-Residential Space	59.20	127.46	176.26	285.93	163.67	77.44
Non-Class Lab	--	1.42	0.70	9.30	3.57	--
Office Space per Total Professional FT Staff	282.80	370.77	426.46	442.53	377.84	256.19
Office Space per Total Professional FTE Staff	160.79	307.80	343.19	345.28	293.03	218.69

* Excluding labs used for research only.

APPENDIX TABLE 5.3

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

A. Public Universities

	Less than 10,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	7,569	6,129	6,270	5,667	6,421
Class	11.36	13.75	16.25	17.37	14.72
Lab*	12.06	17.60	24.61	32.03	21.40
Class + Lab*	23.42	31.35	40.86	49.40	36.03
Office	16.69	26.61	29.64	42.20	28.56
Study	8.77	12.16	13.93	18.09	13.14
Special Use	8.47	15.33	24.38	31.49	19.72
General Use	11.70	17.93	27.57	27.12	20.87
Support	8.88	11.50	11.10	19.64	12.57
Total Non-Residential Space	82.09	122.82	155.43	212.86	142.12
Non-Class Lab	3.96	8.93	10.91	27.72	12.78
Office Space per Total Professional FT Staff	246.94	279.42	320.16	334.95	296.89
Office Space per Total Professional FTE Staff	209.39	241.12	268.62	286.59	252.65

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

A. Public Universities (Cont'd)

	10,000 - 20,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	14.858	15,131	15,539	13,877	14,869
Class	10.68	10.86	11.91	13.74	11.76
Lab*	13.70	14.79	18.37	23.79	17.55
Class + Lab*	24.38	25.65	30.28	37.53	29.31
Office	19.89	23.70	27.83	37.56	27.06
Study	7.96	10.57	10.70	13.41	10.61
Special Use	10.08	11.35	15.97	26.75	15.84
General Use	9.12	15.41	17.20	21.66	15.74
Support	6.44	11.55	14.45	20.99	13.22
Total Non-Residential Space	83.61	107.27	133.43	185.13	126.31
Non-Class Lab	5.73	8.48	16.22	25.85	13.86
Office Space per Total Professional FT Staff	279.33	346.29	366.28	343.72	332.64
Office Space per Total Professional FTE Staff	238.79	270.96	282.99	275.59	266.31

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

A. Public Universities (Cont'd)

	Over 20,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	26,731	31,594	30,083	24,368	28,449
Class	8.76	10.67	10.79	10.47	10.15
Lab*	12.72	13.31	21.85	18.61	16.49
Class + Lab*	21.48	23.98	32.64	29.08	26.64
Office	25.27	35.43	43.42	40.86	35.94
Study	9.87	15.24	14.49	13.37	13.23
Special Use	10.04	20.13	14.92	28.73	17.77
General Use	8.89	17.81	14.24	20.95	15.11
Support	8.50	15.96	18.81	26.13	16.76
Total Non-Residential Space	96.14	154.89	174.67	201.80	153.88
Non-Class Lab	11.86	22.69	32.77	39.85	25.92
Office Space per Total Professional FT Staff	426.09	374.63	348.53		387.38
Office Space per Total Professional FTE Staff	306.00	313.54	243.97		289.65

*Excluding labs used for research only.

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APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

B. Private Universities

	Less than 10,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	5,775	3,966	3.135	2,817	3,939
Class	14.59	19.33	23.62	37.51	23.37
Lab*	10.82	18.07	17.38	31.06	18.64
Class + Lab*	25.41	37.40	41.00	64.68	41.48
Office	18.74	32.38	35.79	77.41	40.57
Study	10.14	15.14	27.61	46.59	24.56
Special Use	11.15	16.82	24.68	34.24	21.33
General Use	15.62	25.51	37.22	77.64	37.89
Support	5.65	10.51	14.17	47.93	19.17
Total Non-Residential Space	89.75	144.10	187.80	403.46	203.50
Non-Class Lab	2.75	8.06	10.56	84.67	22.79
Office Space per Total Professional FT Staff	233.82	314.87	302.61	352.89	300.88
Office Space per Total Professional FTE Staff	192.42	264.52	268.42	306.56	258.20

*Excluding labs used for research only.

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APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

B. Private Universities (Cont'd)

	10,000 - 20,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	15,655	12,741	13,522	13,433	13,910
Class	12.83	15,07	19.04	20.43	16.26
Lab*	12.05	16.29	19.47	17.08	15.81
Class + Lab*	24.88	31.36	38.51	37.53	32.08
Office	26.64	39.62	41.77	71.24	42.48
Study	11.80	26.81	25.13	44.74	25.56
Special Use	5.53	15.85	17.26	12.16	12.30
General Use	8.85	22.85	25.87	33.06	21.30
Support	7.98	13.92	42.51	26.69	20.41
Total Non-Residential Space	98.54	187.27	213.78	274.05	183.31
Non-Class Lab	11.70	33.80	21.32	47.86	27.49
Office Space per Total Professional FT Staff	384.56	249.49	335.36		321.61
Office Space per Total Professional FTE Staff	340.51	197.28	249.37		264.01

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

C. Public Other Four-Year Schools

	Less than 2,500 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	1,456	1,632	1,540	1,166	1,451
Class	16.63	15.62	20.43	76.82	32.04
Lab*	9.63	16.23	23.02	28.78	19.40
Class + Lab*	25.38	31.84	42.76	103.80	50.54
Office	11.73	16.59	19.32	43.87	22.72
Study	6.90	12.58	17.33	26.62	15.98
Special Use	4.89	13.34	21.78	29.67	17.82
General Use	8.38	16.77	26.63	42.10	23.71
Support	4.09	7.07	9.78	19.25	10.17
Total Non-Residential Space	58.49	98.09	137.60	262.13	138.14
Non-Class Lab	0.92	1.09	2.44	1.44	1.48
Office Space per Total Professional FT Staff	174.31	219.46	267.85	294.84	241.99
Office Space per Total Professional FTE Staff	163.02	207.28	256.79	282.49	230.26

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

C. Public Other Four-Year Schools (Cont'd)

	2,500 - 5,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	4,069	3,662	3,541	3,664	3,733
Class	12.25	13.53	14.33	20.01	15.14
Lab*	12.33	14.86	19.10	20.31	16.73
Class + Lab*	24.58	28.39	33.43	40.32	31.86
Office	12.22	15.03	15.39	20.06	15.77
Study	5.93	11.39	10.26	12.43	10.05
Special Use	8.63	11.96	18.60	24.94	16.22
General Use	11.17	16.50	20.69	28.92	19.52
Support	4.28	7.09	9.05	10.68	7.84
Total Non-Residential Space	67.09	91.34	108.39	139.17	101.77
Non-Class Lab	0.83	1.11	1.17	1.86	1.28
Office Space per Total Professional FT Staff	181.59	232.91	237.17	269.53	231.26
Office Space per Total Professional FTE Staff	175.37	219.85	230.36	258.09	221.90

*Excluding labs used for research only.

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APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

C. Public Other Four-Year Schools (Cont'd)

	5,000 - 10,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	7,332	7,655	6,781	6,457	7,028
Class	9.39	11.76	12.05	16.68	12.67
Lab*	10.49	12.96	15.87	18.47	14.64
Class + Lab*	19.89	24.72	27.92	35.15	27.31
Office	11.77	13.63	15.81	19.90	15.50
Study	6.01	9.03	8.73	10.39	8.69
Special Use	7.40	11.61	16.12	24.81	15.45
General Use	9.80	13.52	16.57	20.07	15.23
Support	4.42	6.27	7.83	9.11	7.01
Total Non-Residential Space	60.56	80.05	94.01	121.17	90.48
Non-Class Lab	1.74	1.35	1.07	1.74	1.48
Office Space per Total Professional FT Staff	187.66	227.07	254.38	289.66	243.36
Office Space per Total Professional FTE Staff	168.60	309.52	236.84	268.68	248.22

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

C. Public Other Four-Year Schools (Cont'd)

	10,000 - 20,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	14,014	12,713	13,907	12,552	13,297
Class	7.28	9.99	11.60	11.71	10.15
Lab*	12.70	10.65	16.47	18.66	14.62
Class + Lab*	19.98	20.64	28.07	30.37	24.77
Office	10.98	14.29	13.33	16.91	13.88
Study	4.03	6.14	8.92	9.98	7.27
Special Use	5.24	6.58	11.36	10.39	8.39
General Use	4.05	4.45	6.57	8.24	5.83
Support	3.33	4.75	4.83	7.55	5.12
Total Non-Residential Space	48.89	57.51	73.93	85.45	66.45
Non-Class Lab	1.27	0.66	0.86	2.01	1.20
Office Space per Total Professional FT Staff	185.22	222.22	214.98	226.92	212.34
Office Space per Total Professional FTE Staff	167.49	209.01	193.68	209.57	194.94

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

D. Private Other Four-Year Schools

	Less than 1,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	550	604	631	522	577
Class	21.16	26.86	31.55	38.79	24.61
Lab*	10.97	19.95	26.92	36.46	24.24
Class + Lab*	29.76	45.69	58.26	74.96	52.12
Office	14.80	22.97	26.50	35.02	24.80
Study	12.63	19.02	23.66	35.40	22.70
Special Use	13.35	19.07	26.20	39.70	25.49
General Use	21.62	42.87	56.72	83.52	51.30
Support	5.97	12.62	18.84	29.65	17.23
Total Non-Residential Space	92.97	160.25	207.91	298.59	189.71
Non-Class Lab	2.15	1.85	1.84	3.37	2.37
Office Space per Total Professional FT Staff	218.66	253.28	270.82	306.51	262.95
Office Space per Total Professional FTE Staff	179.77	229.57	246.77	267.77	231.85

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

D. Private Other Four-Year Schools (Cont'd)

	1,000 - 2,500 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	1,564	1,504	1,404	1,441	1,478
Class	15.86	19.91	23.20	29.83	22.17
Lab*	11.64	19.34	21.15	31.85	21.02
Class + Lab*	27.16	39.25	44.35	61.67	43.04
Office	15.11	21.38	22.91	32.14	22.85
Study	9.95	15.50	18.37	25.59	17.32
Special Use	9.94	19.17	25.36	36.44	22.82
General Use	19.13	32.03	42.87	63.37	39.34
Support	5.43	9.62	16.48	26.87	14.66
Total Non-Residential Space	86.46	138.23	171.94	249.35	161.18
Non-Class Lab	1.14	1.43	2.16	3.74	2.23
Office Space per Total Professional FT Staff	213.82	260.43	278.18	317.03	268.50
Office Space per Total Professional FTE Staff	188.52	241.60	262.43	298.19	248.96

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

D. Private Other Four-Year Schools (Cont'd)

	2,500 - 5,000 Enrollment					Over 5,000 Enrollment
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean	Mean
Full-Time Enrollment	3,519	3,494	3,054	2,613	3,170	5,503
Class	13.79	16.68	18.22	19.41	17.03	15.29
Lab*	7.69	14.89	16.01	23.66	15.56	8.25
Class + Lab*	21.48	31.57	34.23	43.06	32.59	23.55
Office	15.16	17.07	19.51	26.46	19.55	18.21
Study	8.96	8.92	16.36	20.33	13.64	12.02
Special Use	5.30	10.88	12.87	29.70	14.69	5.75
General Use	12.28	22.31	32.98	38.77	26.59	17.70
Support	4.99	6.00	8.08	17.57	9.16	8.32
Total Non-Residential Space	69.65	98.56	126.48	179.98	118.67	86.51
Non-Class Lab	0.94	1.81	3.06	4.08	2.53	0.59
Office Space per Total Professional FT Staff	222.25	216.66	271.84	309.39	254.47	
Office Space per Total Professional FTE Staff	181.56	188.89	243.48	283.78	223.73	

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

E. Public Two-Year Schools

	Less than 1,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	580	578	579	506	561
Class	14.51	19.89	24.66	42.73	25.43
Lab*	12.94	23.29	29.87	44.76	27.68
Class + Lab*	26.99	43.17	54.17	85.87	52.53
Office	8.76	11.96	14.28	20.90	13.93
Study	6.15	8.76	12.36	19.82	11.74
Special Use	5.31	13.01	21.96	29.25	19.08
General Use	6.30	9.86	15.84	24.46	14.37
Support	2.30	3.15	5.28	10.72	5.80
Total Non-Residential Space	50.42	85.00	119.94	184.56	109.76
Non-Class Lab	0.86	3.95	0.73	1.76	1.52
Office Space per Total Professional FT Staff	139.70	171.86	210.83	257.42	194.57
Office Space per Total Professional FTE Staff	116.42	153.35	184.39	230.88	170.97

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

E. Public Two-Year Schools (Cont'd)

	1,000 - 2,500 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	1,655	1,607	1,599	1,478	1,584
Class	9.44	13.87	16.54	24.53	16.17
Lab*	8.35	15.04	25.76	33.76	20.85
Class + Lab*	17.79	28.90	42.30	58.29	37.02
Office	6.89	9.37	11.15	14.31	10.47
Study	3.27	5.78	6.81	10.01	6.53
Special Use	2.26	7.33	11.70	18.57	10.54
General Use	3.73	7.41	9.62	18.60	9.92
Support	1.56	1.79	4.82	10.51	4.88
Total Non-Residential Space	34.81	59.07	85.60	129.42	77.71
Non-Class Lab	0.35	0.26	1.18	0.61	0.63
Office Space per Total Professional FT Staff	110.39	160.24	183.32	228.52	171.19
Office Space per Total Professional FTE Staff	97.15	141.18	163.52	204.76	152.18

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

E. Public Two-Year Schools (Cont'd)

	2,500 - 5,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	3,494	3,645	3,368	3,356	3,466
Class	9.99	10.77	12.36	16.65	12.44
Lab*	10.65	18.46	21.07	33.55	20.93
Class + Lab*	20.65	29.23	33.43	50.20	33.38
Office	7.73	8.32	10.82	13.72	10.15
Study	3.26	5.38	6.84	8.43	5.98
Special Use	4.98	7.51	10.94	12.74	9.09
General Use	5.40	7.10	9.58	15.49	9.39
Support	2.05	3.17	3.46	6.74	3.87
Total Non-Residential Space	43.80	60.81	75.09	107.56	71.82
Non-Class Lab	0.07	0.18	0.08	0.39	0.23
Office Space per Total Professional FT Staff	130.68	167.50	195.92	202.83	174.41
Office Space per Total Professional FTE Staff	112.91	147.20	168.76	176.38	109.73

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

E. Public Two-Year Schools (Cont'd)

	Over 5,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	8,553	6,939	6,049	5,753	6,824
Class	10.22	9.62	9.83	13.90	10.89
Lab*	12.43	16.42	22.35	22.47	18.42
Class + Lab*	22.65	26.04	32.18	36.37	29.31
Office	6.79	8.74	8.92	13.33	9.45
Study	3.68	3.94	4.37	6.57	4.64
Special Use	6.14	8.63	11.26	10.64	9.17
General Use	4.08	7.54	8.97	9.82	7.60
Support	1.48	4.62	3.76	6.41	4.07
Total Non-Residential Space	44.82	59.57	69.46	83.16	64.25
Non-Class Lab		0.14			
Office Space per Total Professional FT Staff	144.44	168.73	188.01	231.40	189.67
Office Space per Total Professional FTE Staff	132.08	140.43	167.11	194.10	163.28

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

F. Private Two-Year Schools

	Less than 1,000 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	427	413	346	257	361
Class	22.32	26.45	29.54	45.42	30.93
Lab*	8.71	14.81	20.57	28.84	18.79
Class + Lab*	29.41	39.89	50.12	74.26	48.42
Office	9.67	19.76	23.13	34.19	21.69
Study	8.78	15.08	20.04	35.02	19.82
Special Use	8.99	20.90	28.76	59.99	33.95
General Use	11.53	31.92	49.84	86.41	45.52
Support	5.78	11.08	20.15	25.94	16.75
Total Non-Residential Space	65.17	134.34	184.94	309.17	173.41
Non-Class Lab		1.47	0.70	13.76	4.90
Office Space per Total Professional FT Staff	160.86	257.87	279.46	280.54	246.36
Office Space per Total Professional FTE Staff	118.90	224.89	235.82	245.79	208.13

*Excluding labs used for research only.

APPENDIX TABLE 5.3 (Cont'd)

SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL, DETAIL OF SPACE BY FUNCTION

(Square Feet per Full-Time Student)

F. Private Two-Year Schools (Cont'd)

	1,000 - 2,500 Enrollment				
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Full-Time Enrollment	1,156	1,844	1,417	1,294	1,428
Class	11.33	14.99	13.63	20.22	15.04
Lab*	5.25	4.57	8.89	12.84	7.89
Class + Lab*	16.58	19.56	22.52	33.05	22.93
Office	4.88	10.40	9.59	15.73	10.15
Study	5.13	4.94	7.95	12.75	7.69
Special Use			10.07	18.43	14.25
General Use	3.40	8.29	19.94	39.64	17.82
Support	4.27	3.03	7.10	10.43	6.38
Total Non-Residential Space	33.03	14.99	77.18	130.08	63.82
Non-Class Lab					
Office Space per Total Professional FT Staff	115.25	206.81	161.86	275.67	189.90
Office Space per Total Professional FTE Staff	93.70	160.66	141.29	266.59	165.66

*Excluding labs used for research only.

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APPENDIX TABLE 5.4

STANDARD DEVIATIONS OF TYPE OF SPACE BY TYPE, CONTROL, AND SIZE OF SCHOOL, RANKED ON INDIVIDUAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, TOTAL SPACE PER FULL-TIME STUDENT, AND TOTAL SPACE PER FULL-TIME-EQUIVALENT STUDENT

A. Public Universities

Square Feet		Less than 10,000 Enrollment				10,000 - 20,000 Enrollment				Over 20,000 Enrollment			
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Class:	FTE	1.1623	1.4230	1.2505	2.8825	0.8122	0.4682	0.5054	1.9451	0.3624	0.8535	0.4039	0.8719
	FT	3.6133	4.2067	5.3749	6.8290	1.1218	2.1005	2.6009	3.5768	1.9102	1.1445	2.8726	0.6142
	FTE	3.7778	4.0480	5.6028	5.8525	1.9040	2.4732	1.4071	3.0888	1.6607	1.4383	1.6823	1.7143
Lab*:	FTE	3.1044	1.7412	1.0233	9.0289	1.7409	1.4934	1.2264	4.9326	2.1588	0.6090	1.3872	2.2878
	FT	4.8376	5.5820	8.9561	11.0554	3.4056	3.7956	3.6394	7.4888	5.1323	2.2250	2.2971	4.2646
	FTE	3.8611	4.8108	9.6574	9.0701	3.6720	4.7348	4.0635	6.5251	3.8404	2.7568	2.5128	3.8678
Class + Lab*:	FTE	3.8550	2.7836	1.4669	9.5358	2.5582	1.5852	1.6255	5.3117	3.3789	1.0194	0.9639	2.4354
	FT	6.3357	7.2476	8.1906	16.3566	4.5408	4.5928	4.4739	6.8863	6.0006	2.8756	2.6120	3.7616
	FTE	5.9981	7.0367	8.7885	13.4919	4.8414	5.0775	4.7578	6.6444	6.1498	2.1938	3.3983	3.7662
Office:	FTE	2.8935	2.3429	1.8042	18.4065	2.3488	1.6612	1.8506	5.7496	5.9538	1.8197	2.7682	3.7206
	FT	3.8295	12.4024	8.4052	21.6568	5.5073	5.6413	5.0492	6.9323	4.5414	5.8331	5.9296	0.4124
	FTE	4.7286	12.2636	10.6223	18.5984	2.9971	4.3363	4.6314	7.4320	5.9538	2.4243	3.4327	3.7206
Study:	FTE	1.8838	0.8870	0.7366	6.6550	1.2794	0.9576	0.7713	1.9010	1.4014	0.6754	0.7000	3.4633
	FT	4.1149	3.1207	6.0381	10.7346	3.2353	3.8113	3.1113	3.5226	2.6581	3.4275	7.0237	3.1927
	FTE	3.9712	2.4850	3.5330	8.5454	2.6526	3.0479	3.6301	3.1531	2.9950	2.3435	3.3048	4.6216
Special Use:	FTE	2.1562	2.2925	3.7387	11.0467	1.5857	1.2349	1.0291	11.3059	0.7542	1.8726	2.0873	6.4985
	FT	4.1218	8.1710	8.1362	19.0349	6.4875	4.8317	6.6786	14.7344	6.9557	3.7966	5.5504	9.9476
	FTE	4.2277	7.4937	7.6519	18.6602	5.8479	3.9552	6.0330	13.7221	1.1685	5.7329	2.9874	9.6428
General Use:	FTE	2.5865	3.3778	0.4960	9.1394	1.9246	0.8761	0.8527	4.8438	2.1098	0.9855	1.8062	6.0116
	FT	4.1966	6.6339	13.5280	8.3613	3.5363	7.5447	4.3943	7.1879	1.7128	7.2559	3.0008	6.5222
	FTE	4.3083	6.7105	13.3997	7.3195	4.3593	4.6504	5.4863	5.5250	2.3713	2.7683	8.9478	5.2969
Support:	FTE	1.7314	0.9406	0.8758	4.1498	1.2124	1.1222	1.8135	6.8092	1.8811	1.3459	1.5284	10.6276
	FT	9.0988	4.2454	3.7104	7.1465	3.5990	8.5984	6.8057	9.0541	3.7713	4.2412	7.7509	18.9053
	FTE	3.8466	2.7446	3.4271	5.3999	5.9823	8.5398	6.3944	8.1913	3.4557	6.2113	2.9717	12.8098
Total Non-Residential Space:	FTE	19.9028	7.5675	11.8730	24.9914	12.6470	6.0007	7.1684	33.0740	19.7465	9.2117	7.9055	12.6367
	FT	19.1804	8.2676	13.6126	33.7957	14.8471	8.0743	8.6231	33.3217	15.8339	6.3199	10.6140	7.0554
	FTE	10.9028	7.5675	11.8730	24.9914	12.6470	6.0007	7.1684	33.0740	19.7465	9.2117	7.9055	17.6367

* Excluding labs used for research only.

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APPENDIX TABLE 5.4 (Cont'd)

STANDARD DEVIATIONS OF TYPE OF SPACE BY TYPE, CONTROL, AND SIZE OF SCHOOL, RANKED ON INDIVIDUAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, TOTAL SPACE PER FULL-TIME STUDENT, AND TOTAL SPACE PER FULL-TIME-EQUIVALENT STUDENT

B. Private Universities

Square Feet		Less than 10,000 Enrollment				10,000 - 20,000 Enrollment				Over 20,000 Enrollment
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Class:	FTE	1.1974	1.5142	1.7949	11.9406	1.5916	0.3590	1.8671	1.7992	3.5047
	FT	2.6085	6.2613	10.0447	46.2707	3.9035	2.6073	0.5717	2.3406	
	FTE	4.6727	4.5259	6.9860	13.7793	1.5916	0.3590	0.5885	2.9157	
Lab*:	FTE	2.1226	1.6001	2.5078	7.6158	0.1451	2.1994	0.2140	2.8651	4.1066
	FT	5.7378	8.3810	7.3138	11.0987	4.9025	0.8476	5.4687	7.9176	
	FTE	3.6034	7.5757	6.3984	10.5105	0.1451	0.0249	4.0902	4.1501	
Class + Lab*:	FTE	3.7028	2.6796	4.6682	8.5719	1.7367	0.3342	0.0835	3.4929	6.7388
	FT	7.1875	10.0953	10.5061	39.8800	8.7006	2.6176	6.0404	5.5770	
	FTE	5.0978	8.9285	9.2317	13.4086	1.7367	0.3342	4.6787	3.2611	
Office:	FTE	2.5416	2.9894	4.3529	31.0615	1.9267	0.4055	4.1697	13.9109	5.6824
	FT	3.3567	14.0203	16.0190	38.1909	7.1928	7.4591	3.3325	2.7973	
	FTE	9.2510	8.7795	18.2461	34.5912	1.9267	0.4055	4.7425	14.1501	
Study:	FTE	2.3738	2.0104	4.0321	18.6105	3.8148	0.4648	0.5100	9.2038	3.7806
	FT	3.9102	8.1049	9.9234	24.4372	7.7112	10.5751	1.4315	5.6632	
	FTE	4.1587	8.9384	9.9187	20.5495	3.8148	0.4648	8.1964	11.2489	
Special Use:	FTE	2.2663	1.2588	3.7310	15.1976	0.6706	0.7450	0.6496	4.4006	7.9896
	FT	7.0366	9.4947	14.8260	20.4163	3.2892	6.6987	2.0096	4.9892	
	FTE	3.3163	7.6707	10.9209	20.2892	0.0872	3.8404	2.4508	6.4353	
General Use:	FTE	3.1894	2.9511	5.4171	29.5150	0.8446	1.0526	2.2928	8.0174	3.9486
	FT	6.3187	13.4532	19.3207	89.2117	2.7509	11.8841	0.4551	13.3200	
	FTE	6.3907	12.3055	17.5014	34.3834	1.6426	15.9585	6.7740	9.4058	
Support:	FTE	1.2601	2.0591	1.4424	39.4728	0.3472	4.2618	0.4767	11.4258	5.2188
	FT	3.5530	6.8231	4.5545	46.5652	5.6462	1.7899	14.6251	10.1341	
	FTE	3.0310	4.6318	4.6512	40.9436	0.3472	6.5674	24.3864	8.6457	
Total Non-Residential Space	FTE	15.4750	12.7244	18.2435	156.2962	1.7974	29.8058	9.4730	34.6769	23.6193
	FT	17.0266	16.8222	17.6827	223.1669	34.9718	13.6957	0.9743	20.8186	
	FTE	15.4750	12.7244	18.2435	156.2962	1.7974	29.8058	9.4730	34.6769	

* Excluding labs used for research only.

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APPENDIX TABLE 5.4 (Cont'd)

STANDARD DEVIATIONS OF TYPE OF SPACE BY TYPE, CONTROL, AND SIZE OF SCHOOL, RANKED ON INDIVIDUAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, TOTAL SPACE PER FULL-TIME STUDENT, AND TOTAL SPACE PER FULL-TIME-EQUIVALENT STUDENT

C. Public Other Four-Year Schools

Square Feet		Less than 2,500 Enrollment				2,500 - 5,000 Enrollment			
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Class:	FTE	2.1206	1.6150	1.2447	6.9767	1.6413	0.7914	0.9322	8.7046
	FT	11.5052	5.1267	6.6159	288.1780	3.8105	3.8200	3.8940	9.9207
	FTE	4.6128	7.5289	6.6747	6.9428	4.0229	3.1107	4.1497	10.0366
Lab*:	FTE	2.7399	1.5957	1.9973	9.0330	2.5284	1.0024	1.7226	4.8464
	FT	5.9325	6.8865	10.3265	11.9315	5.3787	3.9546	8.4063	6.2919
	FTE	4.8381	4.9869	11.0650	10.2140	4.7631	6.1353	6.2108	6.5152
Class + Lab*:	FTE	5.1579	2.4598	3.1850	8.7958	3.8973	2.1323	1.7982	9.4701
	FT	10.8662	9.3372	12.8639	283.4465	7.6115	4.0313	9.9522	9.8434
	FTE	6.9745	6.9700	12.7848	11.4529	7.1509	7.4132	8.1002	11.6057
Office:	FTE	2.1914	1.2167	1.3468	8.3306	1.8377	0.7411	1.2538	3.1019
	FT	3.3038	5.9770	6.7499	103.4290	3.7539	3.5692	2.9695	4.0357
	FTE	4.2052	6.3253	6.1885	9.5149	4.0561	2.9265	3.4602	4.6326
Study:	FTE	1.6394	1.2925	1.3436	11.2281	1.1927	1.0778	1.0164	2.1235
	FT	3.7646	6.1800	12.2055	50.8584	2.6694	4.1534	3.8018	4.6810
	FTE	4.4382	6.2799	12.0915	9.4135	3.1694	3.2708	3.8942	4.3528
Special Use:	FTE	0.5516	3.4294	2.2483	14.4120	2.4166	1.1011	3.1774	7.3455
	FT	6.6452	8.2524	10.4256	18.0544	4.1138	4.8577	8.9277	11.4050
	FTE	5.8492	7.8703	9.4966	16.1533	4.2742	4.1859	7.6445	10.8705
General Use:	FTE	2.7742	2.4467	3.3329	11.6300	2.9146	1.5709	2.5632	5.0267
	FT	4.9588	7.1854	9.6389	16.5901	4.0109	6.0855	6.5468	6.6533
	FTE	3.9404	7.5282	8.4198	16.2385	4.0994	4.6407	5.4448	6.5994
Support:	FTE	0.8263	1.1346	1.2734	9.0439	0.9490	0.8168	1.0863	4.5287
	FT	3.5576	5.2173	6.0913	28.8663	3.0811	3.4060	5.5754	6.3572
	FTE	4.4024	3.8987	10.1249	7.3877	2.7186	3.0692	4.0050	6.4376
Total Non-Residential Space:	FTE	16.5594	11.4821	8.7905	22.3002	15.2581	6.3400	6.4072	18.2386
	FT	15.4538	11.7842	8.8238	449.8987	11.0911	3.3037	6.9220	13.4234
	FTE	16.5594	11.4821	8.7905	22.3002	15.2581	6.3400	6.4072	18.2386

* Excluding labs used for research only.

APPENDIX TABLE 5.4 (Cont'd)

STANDARD DEVIATIONS OF TYPE OF SPACE BY TYPE, CONTROL, AND SIZE OF SCHOOL, RANKED ON INDIVIDUAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, TOTAL SPACE PER FULL-TIME STUDENT, AND TOTAL SPACE PER FULL-TIME-EQUIVALENT STUDENT

C. Public Other Four-Year Schools (Cont'd)

Square Feet		5,000 - 10,000 Enrollment				Over 10,000 Enrollment			
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Class:	FTE	0.9387	0.6121	0.6532	2.5404	0.7557	0.4011	1.0602	1.2722
	FT	2.4365	2.7740	2.8507	4.4627	0.8060	4.7351	3.1055	2.0447
	FTE	1.5531	1.9734	3.4519	4.1852	0.8218	2.0370	3.3228	2.3202
Lab*:	FTE	1.3318	1.2452	0.5487	4.5286	1.4235	0.8931	0.7015	3.1767
	FT	3.9487	4.4323	3.2040	5.8700	3.9547	3.6519	8.6374	5.0170
	FTE	2.7132	4.9164	3.4358	5.3968	2.2154	3.1227	5.8157	2.5015
Class + Lab*:	FTE	2.5493	1.6821	1.9301	4.5922	1.9125	1.1037	0.6801	1.6065
	FT	5.0667	4.9163	4.3830	8.1156	3.1521	1.2395	7.2168	3.9867
	FTE	3.1184	4.7903	3.9112	6.4704	2.3436	3.6978	3.7443	2.9636
Office:	FTE	1.2833	0.7621	1.3191	1.9927	1.5396	0.2207	1.0235	2.8925
	FT	2.9423	3.8458	4.8778	3.6462	1.9822	1.8680	1.0989	1.7049
	FTE	1.6636	2.8812	3.4416	3.0858	1.8829	1.6069	2.6953	4.2690
Study:	FTE	1.1903	0.4670	0.7375	1.9771	0.9116	0.4023	0.8632	1.7699
	FT	2.5694	3.9388	2.8641	3.8700	0.7551	1.9748	2.0217	6.5340
	FTE	2.8356	2.8581	2.9679	3.5803	1.0050	0.9301	1.2962	3.2755
Special Use:	FTE	0.6113	1.5896	1.3432	5.7489	0.9453	0.1797	0.6487	4.6953
	FT	3.7317	4.9828	7.0766	9.8979	3.3213	2.5494	3.2393	8.3919
	FTE	3.7430	4.0701	7.2531	8.8744	2.4395	2.3348	3.4662	7.5712
General Use:	FTE	2.4145	1.4439	0.8934	2.9022	0.5135	0.7437	1.2560	2.8141
	FT	5.6640	4.6734	4.9178	5.3989	2.7178	3.2391	5.7524	4.8604
	FTE	4.2702	4.6069	4.7873	4.3445	1.5968	3.5603	2.7341	6.1101
Support:	FTE	0.4520	0.6982	0.8728	3.2569	0.6689	0.5724	1.2023	3.4126
	FT	3.1849	4.3455	4.2533	5.1665	1.0880	0.7006	4.7188	4.0840
	FTE	1.8179	4.2939	3.8795	4.1130	0.9256	3.0269	6.0251	1.8226
Total Non-Residential Space:	FTE	9.0045	5.8998	5.0390	12.4809	2.4569	5.9002	3.0412	6.7339
	FT	9.3098	6.1253	3.4687	16.0738	4.7334	7.1435	4.6312	5.7393
	FTE	9.0045	5.8998	5.0390	12.4809	2.4569	5.9002	3.0412	6.7339

* Excluding labs used for research only.

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APPENDIX TABLE 5.4 (Cont'd)

STANDARD DEVIATIONS OF TYPE OF SPACE BY TYPE, CONTROL, AND SIZE OF SCHOOL, RANKED ON INDIVIDUAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, TOTAL SPACE PER FULL-TIME STUDENT, AND TOTAL SPACE PER FULL-TIME-EQUIVALENT STUDENT

D. Private Other Four-Year Schools

Square Feet		Less than 1,000 Enrollment				1,000 - 2,500 Enrollment			
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Class:	FTE	3.2686	2.1328	2.1358	11.9441	2.8012	1.1849	1.4508	9.2617
	FT	11.2891	10.8944	11.8232	16.1690	5.7007	5.7246	8.1250	12.6379
	FTE	9.9414	9.3129	12.1904	13.1893	6.2669	5.3989	7.7806	11.4191
Lab*:	FTE	2.7851	2.7273	3.0708	10.8712	3.2252	1.9150	1.9449	9.2072
	FT	8.0614	10.4224	11.1047	17.5914	6.8296	6.8840	6.6401	13.1201
	FTE	7.6210	9.5082	11.2639	16.1613	5.6714	6.3921	6.9992	12.9172
Class + Lab*:	FTE	7.2299	4.0810	4.0811	12.4901	6.3750	2.6139	2.7499	15.1280
	FT	12.8849	13.4284	15.6973	20.7895	9.3000	10.3452	8.6314	19.7447
	FTE	11.8079	12.4066	14.9536	18.4425	8.7644	9.2125	10.0407	19.2280
Office:	FTE	3.9323	1.7747	1.6983	7.4841	3.5794	1.0351	1.6521	8.0689
	FT	8.4090	7.2658	7.4874	12.7914	5.5737	5.0417	5.2186	9.7356
	FTE	7.8752	6.4006	6.9987	6.6522	5.2448	5.2104	4.9331	9.6537
Study:	FTE	2.9316	1.9133	2.3566	16.7586	2.1573	1.3088	1.9653	11.1804
	FT	8.2378	10.8625	10.7021	20.9774	4.7105	6.3717	7.3030	12.7006
	FTE	8.9454	8.2084		19.2419	3.9854	6.2692	8.7798	12.6906
Special Use:	FTE	1.5167	3.8243	3.7829	20.7266	3.3235	2.0530	2.9150	15.5999
	FT	12.6762	12.3637	18.0853	26.8436	6.0522	9.8420	11.0795	20.0322
	FTE	10.6766	12.7171	17.2772	26.2568	5.9909	9.4879	10.7106	19.3598
General Use:	FTE	8.2965	4.2867	5.6092	23.7007	6.3918	3.0080	4.2113	19.4367
	FT	13.4924	16.9704	19.1582	33.4869	10.2473	10.5968	12.6222	24.2380
	FTE	13.8795	15.5174	17.3402	31.4774	9.3758	8.5164	11.8527	22.9676
Support:	FTE	0.9180	2.1637	2.6735	20.6183	1.3651	1.4686	2.2992	14.5709
	FT	6.0063	10.9585	16.2263	23.7670	5.0286	6.7189	12.2818	18.5181
	FTE	5.8072	11.2747	15.7574	23.0489	4.6843	6.7893	11.2900	17.5797
Total Non-Residential Space:	FTE	29.3757	14.3334	15.9800	45.2064	25.6992	10.1364	10.6733	61.6362
	FT	29.2913	13.2581	17.4560	49.6741	27.0470	10.2803	10.8025	61.6376
	FTE	29.3757	14.3334	15.9800	45.2064	25.6992	10.1364	10.6733	61.6362

* Excluding labs used for research only.

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APPENDIX TABLE 5.4 (Cont'd)

STANDARD DEVIATIONS OF TYPE OF SPACE BY TYPE, CONTROL, AND SIZE OF SCHOOL, RANKED ON INDIVIDUAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, TOTAL SPACE PER FULL-TIME STUDENT, AND TOTAL SPACE PER FULL-TIME-EQUIVALENT STUDENT

D. Private Other Four-Year Schools (Cont'd)

Square Feet		2,500 - 5,000 Enrollment				Over 5,000 Enrollment
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	Mean
Class:	FTE	1.7842	0.7773	1.2768	2.0324	3.7627
	FT	3.8917	4.5572	3.3141	4.2645	3.5161
	FTE	2.9488	3.9144	4.1555	3.6325	3.7627
Lab*:	FTE	1.4605	1.5061	2.3455	4.3484	3.9396
	FT	4.4111	7.5189	4.3358	6.9635	1.2827
	FTE	3.0998	5.3884	5.0726	6.7022	3.9396
Class + Lab*:	FTE	2.6713	1.9827	3.4857	5.5649	6.2847
	FT	4.5620	8.9628	5.3080	7.9784	2.2334
	FTE	3.3946	7.0194	8.0886	8.4883	6.2847
Office:	FTE	2.3996	0.5117	1.0118	6.5948	3.9327
	FT	6.6242	2.5518	4.3477	8.1528	4.3743
	FTE	5.6474	1.8322	3.2321	8.2068	3.9327
Study:	FTE	1.5708	0.9281	1.6958	4.6340	4.9591
	FT	3.5625	2.3590	8.1022	7.2207	10.7965
	FTE	2.9293	4.0165	5.9924	6.6026	4.9591
Special Use:	FTE	1.5546	1.2843	2.0741	9.7346	2.8860
	FT	3.5366	5.2846	4.8676	10.1475	0.3033
	FTE	2.6437	3.9729	4.8399	10.1587	2.8860
General Use:	FTE	3.0463	2.7177	3.0789	11.8503	7.4654
	FT	2.4489	4.3027	15.5598	11.8187	15.2770
	FTE	3.6424	6.9989	14.2506	11.1737	7.4654
Support:	FTE	0.7993	0.3953	1.1420	7.9603	2.4075
	FT	3.3438	3.2749	3.9454	9.6646	0.0582
	FTE	1.5965	2.8275	2.4289	8.9517	2.4075
Total Non-Residential Space:	FTE	9.8499	9.8303	9.6684	38.7105	15.7566
	FT	15.5430	5.9874	11.8277	28.2339	2.2236
	FTE	9.8499	9.8303	9.6684	38.7105	15.7566

* Excluding labs used for research only.

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APPENDIX TABLE 5.4 (Cont'd)

STANDARD DEVIATIONS OF TYPE OF SPACE TY TYPE, CONTROL, AND SIZE OF SCHOOL, RANKED ON INDIVIDUAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, TOTAL SPACE PER FULL-TIME STUDENT, AND TOTAL SPACE PER FULL-TIME-EQUIVALENT STUDENT

E. Public Two-Year Schools

Square Feet		Less than 1,000 Enrollment				1,000 - 2,500 Enrollment			
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Class:	FTE	1.9410	1.4299	2.0784	10.6253	1.3290	0.9079	1.3191	7.4765
	FT	7.8601	9.2672	11.9498	61.2749	3.5606	5.6793	7.2124	18.7187
	FTE	9.0755	9.8773	9.8201	12.6479	3.3268	5.0231	8.0961	7.3585
Lab*:	FTE	2.9249	2.3673	3.1241	12.7637	1.8248	2.2401	2.7593	8.9688
	FT	7.7337	10.9211	14.9818	19.2497	4.5406	5.7623	10.4861	13.9592
	FTE	6.3003	9.3196	12.7139	15.5255	4.2199	5.9467	9.8275	12.6201
Class + Lab*:	FTE	5.7277	3.9789	3.9245	14.5916	3.2048	2.6400	3.5725	12.1330
	FT	10.7881	13.3146	15.2533	57.7066	5.3099	6.4283	11.0689	24.1832
	FTE	10.1269	12.0718	13.3205	18.7402	4.7699	6.4220	10.9239	15.0600
Office:	FTE	1.6987	0.9605	1.0875	5.2820	0.9780	0.6473	0.7819	2.5825
	FT	3.9300	4.3090	4.7474	8.8314	2.3183	3.0013	3.3633	4.2238
	FTE	3.4332	3.4912	4.4324	6.5130	1.8867	2.6098	2.6780	3.8120
Study:	FTE	1.0705	0.8869	1.4315	5.8039	0.6224	0.7067	0.7809	4.4608
	FT	3.7166	4.0535	6.0953	9.2983	2.0182	2.6843	3.2590	5.5895
	FTE	3.3102	4.1067	5.4979	7.5680	1.5766	2.4914	3.4532	5.7623
Special Use:	FTE		1.6343	4.6057	9.6016	0.1168	1.9090	1.8605	6.7462
	FT	6.9525	9.3301	12.6584	16.1890	2.8027	5.4171	7.8308	10.8498
	FTE	4.1299	9.0671	10.4303	14.6369	2.3891	5.5046	7.6672	8.8899
General Use:	FTE	1.1674	1.1910	2.2916	9.9996	0.7882	0.9139	1.8377	6.5258
	FT	3.8628	5.9451	9.0162	12.9922	2.0830	4.3928	5.1329	9.0803
	FTE	3.3355	5.1663	7.0370	12.8137	1.6404	3.7306	4.9319	8.2140
Support:	FTE		0.3888	0.7332	5.6487	0.1603	0.3761	0.7523	10.6309
	FT	3.2999	3.4771	5.3828	8.9399	1.2652	1.6725	5.6819	11.8411
	FTE	3.3589	3.6096	3.5511	6.9227	1.0887	1.4807	5.3619	10.9922
Total Non-Residential Space:	**FTE**	**12.0042**	**7.8574**	**10.0526**	**28.0844**	**6.2286**	**6.4735**	**7.6047**	**23.6336**
	FT	**14.2806**	**8.6430**	**10.4128**	**52.9109**	**8.0428**	**7.4408**	**7.4104**	**29.0527**
	FTE	**12.0042**	**7.8574**	**10.0526**	**28.0844**	**6.2286**	**6.4735**	**7.6047**	**23.6336**

*** Excluding labs used for research only.**

APPENDIX TABLE 5.4 (Cont'd)

STANDARD DEVIATIONS OF TYPE OF SPACE BY TYPE, CONTROL, AND SIZE OF SCHOOL, RANKED ON INDIVIDUAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, TOTAL SPACE PER FULL-TIME STUDENT, AND TOTAL SPACE PER FULL-TIME-EQUIVALENT STUDENT

E. Public Two-Year Schools (Cont'd)

Square Feet		2,500 - 5,000 Enrollment				Over 5,000 Enrollment			
		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Class:	FTE	0.7907	0.5554	0.8093	4.2965	0.6780	0.3053	0.6913	10.1068
	FT	3.2545	2.6607	2.7878	6.0985	1.8633	1.4898	1.8461	2.6374
	FTE	2.6582	2.6594	3.9611	4.8651	1.7709	2.3696	1.8179	10.8156
Lab*:	FTE	2.2066	1.2041	1.3822	8.4829	1.6012	1.0070	1.2503	10.0339
	FT	6.1876	5.9372	4.9976	13.5517	1.6752	6.6457	3.0422	6.7486
	FTE	3.4676	3.6022	3.3165	9.8778	3.5896	3.1480	3.4960	10.8853
Class + Lab*:	FTE	3.1654	1.7488	1.2822	11.2881	2.5775	1.1693	0.8996	16.2611
	FT	6.5151	5.5369	5.5693	17.6070	3.0524	6.8646	1.7860	6.5873
	FTE	3.8382	3.4260	4.2352	12.4685	3.3710	2.9701	2.7669	16.6439
Office:	FTE	0.9074	0.3971	0.7959	1.9662	0.8261	0.2873	0.3508	2.7180
	FT	2.4553	1.6622	2.7870	4.3613	1.4634	2.6176	1.0243	4.0089
	FTE	2.6078	1.5140	2.2285	2.7977	1.4237	1.1941	1.2613	3.4046
Study:	FTE	0.5411	0.4822	0.6318	1.9492	0.4988	0.3219	0.4909	0.7561
	FT	2.3062	2.3424	2.2609	4.0792	2.0215	1.8960	1.0223	1.5678
	FTE	1.5182	1.9208	1.5498	3.0543	1.3599	1.7234	1.3274	1.5328
Special Use:	FTE	1.0856	1.1173	0.6369	2.2474	1.2077	0.6508	0.5411	1.1003
	FT	3.7189	3.7204	3.9744	5.5652	3.2131	3.3590	2.0752	4.0767
	FTE	2.2838	3.2910	2.7114	3.7475	2.2485	2.3741	1.5249	3.5208
General Use:	FTE	1.0247	0.5367	0.9302	4.3029	0.6042	0.5475	0.4504	2.5595
	FT	3.0639	2.4251	3.6412	6.3116	0.8538	1.8357	1.0603	1.9651
	FTE	1.3002	2.1512	2.1810	5.5105	2.0088	1.8189	1.2498	3.5554
Support:	FTE	0.2694	0.2555	0.4158	2.0918	0.3254	0.3603	0.3414	5.7836
	FT	2.4479	2.3147	1.9500	7.0737	0.7484	3.9358	1.3869	2.4032
	FTE	1.5529	1.6570	1.4684	2.6182	0.8465	2.3357	1.2868	6.0424
Total Non-Residential Space:	FTE	6.3863	3.8786	3.1340	16.6194	4.8272	1.6259	3.1588	22.7960
	FT	8.4760	4.2594	4.1542	27.8521	6.5639	3.9006	1.9891	8.2804
	FTE	6.3863	3.8786	3.1340	16.6194	4.8272	1.6259	3.1588	22.7960

* Excluding labs used for research only.

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APPENDIX TABLE 5.4 (Cont'd)

STANDARD DEVIATIONS OF TYPE OF SPACE BY TYPE, CONTROL, AND SIZE OF SCHOOL, RANKED ON INDIVIDUAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, TOTAL SPACE PER FULL-TIME STUDENT, AND TOTAL SPACE PER FULL-TIME-EQUIVALENT STUDENT

F. Private Two-Year Schools

		Less than 1,000 Enrollment				1,000 - 2,500 Enrollment			
Square Feet		First Quartile	Second Quartile	Third Quartile	Fourth Quartile	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Class:	FTE	2.7576	2.3388	2.4174	15.0224	1.9455	1.3727	0.4631	1.6387
	FT	10.9410	16.1300	13.1300	19.8600	2.7281	3.3635	5.1487	3.8756
	FTE	10.3018	16.2769	13.0493	16.4455	2.8171	3.8883	2.8626	4.0699
Lab*:	FTE	1.6408	2.3876	1.8133	11.8276	0.3155	1.8942	1.5173	2.6293
	FT	6.6732	8.2000	9.3700	17.0000	1.6351	1.7933	5.3613	3.2638
	FTE	6.5851	7.9210	9.7626	16.3823	0.9822	3.1435	4.9629	3.3075
Class + Lab*:	FTE	5.2998	3.2436	3.1137	17.6251	2.1512	3.3147	0.9198	2.2182
	FT	10.8600	15.9900	17.6200	24.0700	1.2147	2.7670	10.1499	5.6477
	FTE	10.7411	16.2520	18.1243	20.3593	1.8896	5.7880	3.5443	5.9360
Office:	FTE	3.1196	2.0299	1.8830	9.7635	2.1813	0.3862	2.3854	1.4320
	FT	7.1000	7.3500	8.3500	13.3100	2.6071	3.2003	2.5277	2.0897
	FTE	6.9498	7.1534	7.6107	13.4187	2.[illegible]813	0.3862	3.6877	2.1418
Study:	FTE	2.4471	1.7214	2.6635	21.7298	0.4[illegible]21	0.9149	3.1885	1.1188
	FT	7.5600	8.6600	10.7900	33.0300	2.391[illegible]	2.3290	5.4686	4.2329
	FTE	7.4270	9.4664	8.4433	24.9541	1.5135	1.3286	0.8444	4.0806
Special Use:	FTE	0.1207	4.3135	5.9253	39.8571		4.6295	0.2317	6.6220
	FT	14.6000	16.6600	17.2700	52.7700			4.4303	7.0649
	FTE	13.2416	14.6918	16.0560	47.3390		6.2281	1.6125	6.7391
General Use:	FTE	4.9988	5.4097	7.5454	20.3122	1.0700	2.2690	5.3358	13.0500
	FT	10.4100	14.8500	20.7400	34.5500	0.9690	4.1408	8.9572	14.5770
	FTE	10.2242	13.7792	18.8640	25.6145	1.0700	4.2081	8.8465	14.8642
Support:	FTE	0.2526	1.3704	4.3326	14.9910	1.7919	1.9654	1.5313	6.9458
	FT	7.2800	10.8500	20.2400	16.6200	5.4702	3.6912	3.1939	6.3967
	FTE	4.4421	11.3050	20.1905	15.5492	4.6077	2.3800	9.0425	6.3769
Total Non-Residential Space:	FTE	24.4792	13.8008	18.5434	53.0706	6.9371	5.2424	13.7108	17.7790
	FT	25.7400	16.1300	20.4700	81.7100	7.8440	0.2494	24.8777	16.9987
	FTE	24.4792	13.8008	18.5434	53.0706	6.9371	5.2424	13.7108	17.7790

* Excluding labs used for research only.

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APPENDIX TABLE 5.5

DIFFERENCES IN SPACE AVAILABLE BETWEEN QUARTILES OF SCHOOLS, WITH SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

A. Public Universities

	Less than 10,000 Enrollment			10,000 - 20,000 Enrollment			Over 20,000 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
				Per Cent of Additional Space					
Class	.08	.03	.06	.09	--	.05	.04	.04	-.03
Lab*	.14	.25	.17	.20	-.04	.20	.16	-.10	.35
Class + Lab*	.22	.28	.23	.29	-.04	.26	.19	-.06	.32
Office	.22	.16	.24	.37	.19	.20	.31	.16	.54
Study	.05	.04	.12	.16	.18	-.04	.05	.18	-.01
Special Use	.22	.24	.22	-.11	.43	.22	.13	.31	-.01
General Use	.23	.22	-.01	.10	.18	.14	.13	.26	-.12
Support	.06	.06	.20	.19	.06	.22	.19	.14	.29
All Non-Residential Space (Sq. Ft.)	37.59	30.21	31.02	17.46	17.67	34.14	36.68	28.34	17.78

* Excluding labs used for research only.

APPENDIX TABLE 5.5 (Cont'd)

DIFFERENCES IN SPACE AVAILABLE BETWEEN QUARTILES OF SCHOOLS, WITH SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

B. Private Universities

	Less than 10,000 Enrollment			10,000 - 20,000 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
			Per Cent of Additional Space			
Class	.06	.13	.04	.03	.08	.02
Lab*	.22	-.04	.10	.16	.07	-.07
Class + Lab*	.28	.09	.11	.19	.15	-.05
Office	.11	.23	.22	.30	.20	.63
Study	.13	.15	.15	.13	.25	.13
Special Use	.14	.17	.10	.03	.08	.15
General Use	.24	.22	.21	.21	-.08	.35
Support	.09	.14	.20	.14	.40	-.22
All Non-Residential Space (Sq. Ft.)	44.98	42.55	131.09	53.89	46.75	24.08

* Excluding labs used for research only.

APPENDIX TABLE 5.5 (Cont'd)

DIFFERENCES IN SPACE AVAILABLE BETWEEN QUARTILES OF SCHOOLS, WITH SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

C. Public Other Four-Year Schools

	Less than 2,500 Enrollment			2,500 - 5,000 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
	Per Cent of Additional Space					
Class	.10	.07	.14	.12	.01	.16
Lab*	.13	.18	.14	.24	-.01	.11
Class + Lab*	.25	.24	.27	.36	-.003	.28
Office	.11	.07	.13	.12	.10	.12
Study	.13	.12	-.01	.14	.06	.05
Special Use	.24	.18	.25	.08	.46	.20
General Use	.26	.24	.33	.25	.22	.28
Support	.02	.15	.03	.06	.15	.07
All Non-Residential Space (Sq. Ft.)	38.13	36.49	40.38	26.60	18.67	31.93

* Excluding labs used for research only.

APPENDIX TABLE 5.5 (Cont'd)

DIFFERENCES IN SPACE AVAILABLE BETWEEN QUARTILES OF SCHOOLS, WITH SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

C. Public Other Four-Year Schools (Cont'd)

	5,000 - 10,000 Enrollment			Over 10,000 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
	Per Cent of Additional Space					
Class	.14	.03	.16	.24	.13	.01
Lab*	.23	.12	.15	-.02	.30	-.01
Class + Lab*	.37	.15	.30	.22	.43	-.002
Office	.09	.21	.15	.27	.03	.16
Study	.04	.14	.03	.13	.26	.08
Special Use	.20	.26	.31	.11	.12	.16
General Use	.16	.16	.21	.27	-.08	.56
Support	.13	.09	.003	.002	.25	.03
All Non-Residential Space (Sq. Ft.)	23.95	15.56	23.43	11.36	12.76	13.56

* Excluding labs used for research only.

APPENDIX TABLE 5.5 (Cont'd)

DIFFERENCES IN SPACE AVAILABLE BETWEEN QUARTILES OF SCHOOLS, WITH SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

D. Private Other Four-Year Schools

	Less than 1,000 Enrollment			1,000 - 2,500 Enrollment			2,500 - 5,000 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
				Per Cent of Additional Space					
Class	.08	.10	.08	.08	.11	.06	.09	.09	.05
Lab*	.14	.15	.10	.16	.08	.13	.16	.29	.10
Class + Lab*	.25	.26	.18	.25	.19	.20	.26	.37	.15
Office	.13	.08	.09	.12	.06	.12	.06	.15	.10
Study	.07	.13	.13	.13	.07	.10	.12	.05	.12
Special Use	.10	.16	.16	.16	.19	.16	.23	-.02	.27
General Use	.34	.29	.30	.25	.33	.27	.23	.39	.21
Support	.12	.09	.14	.09	.16	.16	.09	.04	.16
All Non-Residential Space (Sq. Ft.)	62.60	46.12	95.21	40.43	34.17	71.26	30.81	22.63	59.22

* Excluding labs used for research only.

APPENDIX TABLE 5.5 (Cont'd)

DIFFERENCES IN SPACE AVAILABLE BETWEEN QUARTILES OF SCHOOLS, WITH SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

E. Public Two-Year Schools

	Less than 1,000 Enrollment			1,000 - 2,500 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
			Per Cent of Additional Space			
Class	.16	.10	.15	.18	.13	.09
Lab*	.28	.24	.21	.25	.39	.19
Class + Lab*	.45	.33	.36	.44	.51	.28
Office	.10	.09	.08	.09	.09	.07
Study	.10	.10	.09	.10	.06	.09
Special Use	.24	.29	.17	.22	.11	.19
General Use	.11	.14	.21	.13	.12	.22
Support	.02	.05	.09	.02	.11	.14
All Non-Residential Space (Sq. Ft.)	30.94	27.77	49.12	23.60	23.69	40.94

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* Excluding labs used for research only.

APPENDIX TABLE 5.5 (Cont'd)

DIFFERENCES IN SPACE AVAILABLE BETWEEN QUARTILES OF SCHOOLS, WITH SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

E. Public Two-Year Schools (Cont'd)

	2,500 - 5,000 Enrollment			Over 5,000 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
	Per Cent of Additional Space					
Class	.03	.13	.16	.10	.14	.25
Lab*	.38	.23	.39	.26	.33	.31
Class + Lab*	.41	.36	.54	.36	.47	.57
Office	.07	.11	.10	.11	.12	.15
Study	.06	.15	.07	.12	.06	.03
Special Use	.21	.25	.06	.14	.20	--
General Use	.23	.06	.16	.12	.16	.10
Support	.02	.06	.07	.17	.004	.15
All Non-Residential Space (Sq. Ft.)	15.94	11.33	26.18	8.80	7.30	19.76

* Excluding labs used for research only.

APPENDIX TABLE 5.5 (Cont'd)

DIFFERENCES IN SPACE AVAILABLE BETWEEN QUARTILES OF SCHOOLS, WITH SCHOOLS RANKED BY QUARTILE ON TOTAL NON-RESIDENTIAL SPACE PER FULL-TIME-EQUIVALENT STUDENT, BY TYPE, CONTROL, AND SIZE OF SCHOOL

F. Private Two-Year Schools

	Less than 1,000 Enrollment			1,000 - 2,500 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
			Per Cent of Additional Space			
Class	.08	.04	.13	.10	.10	.12
Lab*	.10	.11	.06	.01	.17	-.01
Class + Lab*	.18	.18	.19	.11	.27	.11
Office	.14	.09	.06	.12	.11	.12
Study	.09	.09	.11	-.03	.23	-.06
Special Use	.19	.10	.30	.32	.07	.25
General Use	.28	.42	.28	.40	.13	.75
Support	.13	.12	.06	.08	.19	-.16
All Non-Residential Space (Sq. Ft.)	66.15	48.44	107.59	25.26	48.21	26.87

* Excluding labs used for research only.

APPENDIX TABLE 5.6

INCREMENTAL SPACE PER FULL-TIME STUDENT BY TYPE, CONTROL, AND SIZE OF SCHOOL

A. Public Universities

	Less than 10,000 Enrollment			10,000 - 20,000 Enrollment			Over 20,000 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
				Per Cent of Additional Space					
Class	.06	.08	.03	.01	.06	.04	.04	.01	-.02
Lab*	.15	.22	.18	.05	.20	.13	.01	.86	-.16
Class + Lab*	.21	.29	.21	.06	.25	.17	.07	.87	-.17
Office	.27	.09	.31	.19	.23	.23	.23	.80	-.12
Study	.09	.05	.10	.13	.01	.07	.12	-.08	-.05
Special Use	.19	.28	.18	.06	.25	.26	.23	-.52	.67
General Use	.17	.30	-.01	.31	.10	.11	.20	-.36	.33
Support	.07	-.01	.21	.25	.16	.16	.17	.29	.36
All Non-Residential Space (Sq. Ft.)	36.95	32.60	40.46	20.36	18.20	41.47	44.50	9.97	20.60

*Excluding labs used for research only.

APPENDIX TABLE 5.6 (Cont'd)

INCREMENTAL SPACE PER FULL-TIME STUDENT BY TYPE, CONTROL, AND SIZE OF SCHOOL

B. Private Universities

	Less than 10,000 Enrollment			10,000 - 20,000 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
				Per Cent of Additional Space		
Class	.09	.10	.08	.03	.10	.04
Lab*	.14	-.02	.08	.07	.08	-.07
Class + Lab*	.23	.08	.14	.10	.18	-.03
Office	.27	.08	.25	.20	.05	.86
Study	.10	.29	.11	.23	-.04	.57
Special Use	.11	.18	.06	.16	.03	-.15
General Use	.19	.27	.24	.22	.07	.21
Support	.10	.09	.20	.09	.70	-.46
All Non-Residential Space (Sq. Ft.)	51.05	42.71	168.02	64.73	40.64	34.37

*Excluding labs used for research only.

APPENDIX TABLE 5.6 (Cont'd)

INCREMENTAL SPACE PER FULL-TIME STUDENT BY TYPE, CONTROL, AND SIZE OF SCHOOL

C. Public Other Four-Year Schools

	Less than 2,500 Enrollment			2,500 - 5,000 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
	Per Cent of Additional Space					
Class	-.03	.12	.44	.05	.05	.19
Lab*	.18	.17	.05	.11	.25	.04
Class + Lab*	.18	.28	.48	.16	.30	.23
Office	.13	.07	.19	.12	.02	.16
Study	.15	.12	.07	.23	-.07	.07
Special Use	.23	.21	.06	.14	.39	.21
General Use	.23	.25	.12	.23	.25	.27
Support	.08	.07	.07	.12	.11	.05
All Non-Residential Space (Sq. Ft.)	36.82	39.41	127.71	23.55	17.06	29.93

*Excluding labs used for research only.

APPENDIX TABLE 5.6 (Cont'd)

INCREMENTAL SPACE PER FULL-TIME STUDENT BY TYPE, CONTROL, AND SIZE OF SCHOOL

C. Public Other Four-Year Schools (Cont'd)

	5,000 - 10,000 Enrollment			Over 10,000 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
			Per Cent of Additional Space			
Class	.12	.02	.18	.29	.10	.01
Lab*	.13	.20	.10	-.22	.36	.21
Class + Lab*	.25	.23	.27	.07	.46	.22
Office	.10	.15	.15	.36	-.06	.35
Study	.15	-.02	.06	.23	.17	.10
Special Use	.22	.32	.33	.15	.29	-.09
General Use	.19	.21	.13	.04	.13	.16
Support	.09	.11	.05	.15	.004	.26
All Non-Residential Space (Sq. Ft.)	19.49	14.20	26.45	9.24	16.23	10.36

*Excluding labs used for research only.

APPENDIX TABLE 5.6 (Cont'd)

INCREMENTAL SPACE PER FULL-TIME STUDENT BY TYPE, CONTROL, AND SIZE OF SCHOOL

D. Private Other Four-Year Schools

	Less than 1,000 Enrollment			1,000 - 2,500 Enrollment			2,500 - 5,000 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
					Per Cent of Additional Space				
Class	.09	.10	.08	.08	.10	.09	.10	.06	.02
Lab*	.14	.15	.11	.15	.05	.14	.25	.04	.15
Class + Lab*	.25	.26	.19	.24	.15	.23	.35	.10	.17
Office	.13	.07	.10	.12	.05	.12	.07	.09	.13
Study	.10	.10	.13	.11	.09	.10	-.001	.27	.08
Special Use	.09	.15	.15	.18	.19	.15	.20	.07	.32
General Use	.33	.29	.30	.26	.32	.27	.35	.39	.11
Support	.10	.13	.12	.08	.21	.14	.04	.08	.18
All Non-Residential Space (Sq. Ft.)	64.11	47.94	88.07	50.23	33.39	75.74	28.58	27.28	51.86

*Excluding labs used for research only.

APPENDIX TABLE 5.6 (Cont'd)

INCREMENTAL SPACE PER FULL-TIME STUDENT BY TYPE, CONTROL, AND SIZE OF SCHOOL

E. Public Two-Year Schools

	Less than 1,000 Enrollment			1,000 - 2,500 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
			Per Cent of Additional Space			
Class	.16	.14	.27	.18	.10	.18
Lab*	.30	.19	.22	.27	.42	.18
Class + Lab*	.47	.32	.47	.44	.52	.36
Office	.09	.07	.10	.10	.07	.07
Study	.08	.11	.11	.10	.04	.07
Special Use	.23	.26	.11	.20	.17	.16
General Use	.10	.18	.13	.15	.09	.20
Support	.02	.06	.08	.01	.12	.13
All Non-Residential Space (Sq. Ft.)	34.10	33.98	67.13	25.08	25.82	43.89

*Excluding labs used for research only.

APPENDIX TABLE 5.6 (Cont'd)

INCREMENTAL SPACE PER FULL-TIME STUDENT BY TYPE, CONTROL, AND SIZE OF SCHOOL

E. Public Two-Year Schools (Cont'd)

	2,500 - 5,000 Enrollment			Over 5,000 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
			Per Cent of Additional Space			
Class	.05	.11	.13	-.04	.02	.30
Lab*	.47	.18	.39	.27	.60	.01
Class + Lab*	.52	.29	.52	.23	.62	.31
Office	.04	.17	.09	.13	.02	.32
Study	.13	.10	.05	.02	.04	.16
Special Use	.15	.24	.06	.17	.26	-.05
General Use	.10	.17	.18	.24	.14	.06
Support	.07	.02	.10	.21	-.09	.19
All Non-Residential Space (Sq. Ft.)	16.64	14.36	32.25	14.69	9.95	13.68

*Excluding labs used for research only.

APPENDIX TABLE 5.6 (Cont'd)

INCREMENTAL SPACE PER FULL-TIME STUDENT BY TYPE, CONTROL, AND SIZE OF SCHOOL

F. Private Two-Year Schools

	Less than 1,000 Enrollment			1,000 - 2,500 Enrollment		
	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile	First to Second Quartile	Second to Third Quartile	Third to Fourth Quartile
			Per Cent of Additional Space			
Class	.06	.06	.13	.31	-.04	.12
Lab*	.09	.11	.07	-.06	.14	.07
Class + Lab*	.16	.19	.20	.25	.10	.20
Office	.16	.06	.09	.46	-.03	.12
Study	.10	.09	.12	-.02	.10	.09
Special Use	.18	.15	.25	**	.33	.16
General Use	.32	.34	.30	.41	.38	.37
Support	.08	.17	.05	-.10	.13	.06
All Non-Residential Space (Sq. Ft.)	64.47	53.41	123.77	11.96	30.95	52.86

*Excluding labs used for research only.
**Not reported for first and second quartiles.

APPENDIX TO CHAPTER 6

A STATISTICAL ANALYSIS OF SPACE AVAILABILITY

The lack of clearcut results, based on the stratification of schools by type, control, and size prompted us to attempt a number of statistical analyses to explain the availability of the present stock of non-residential space as a function of enrollments, expenditures, staffing patterns, and orientation of the school measured by the number, level, and types of degrees granted. A special data file was constructed for this purpose.

Description of the Data Base

The data base consisted of data from various HEGIS surveys for the school year 1970-71. These surveys included information on facilities, enrollments, staff, finances, degrees granted, and institutional characteristics or identifiers. Selected data elements from each of these surveys were consolidated by individual institution. In a number of cases, data from one or more of these surveys were missing for an individual institution. Only those institutions which had complete data on each of these surveys were included in our data base. While roughly four per cent of all campuses failed to report space, some additional schools either did not report members of the faculty or give any financial information, or both. In addition, some schools did not report the degrees which they granted, and a few gave no report on their enrollment. As a result, the new data file which excluded these schools accounted for 6.2 million FTE students as contrasted to the estimated 6.7 million FTE fall enrollment for 1970-71. In other words, the reconstituted data file accounted for about 92.5 per cent of the FTE enrollment. Since the objective here is to develop a data base for statistical analysis, completeness is not essential. Considered as a sample of the enrollment for 1970-71, this is a high degree of coverage and should be quite sufficient.

A second (and more difficult) problem associated with the combination of the various segments of the HEGIS surveys was caused by the inconsistent bases on which a number of institutions reported in the various questionnaires. Whereas each survey requested information on a campus-by-campus basis, these institutions reported on an aggregate or all-campus basis. In order to merge the data on a common basis, it was necessary to aggregate the campus-by-campus data to the same level (all-campus basis) on which the other data were reported. Other problems associated with this effort included the identification of double reporting and the few anomalies encountered in the use of FICE codes (i.e., neither did the same institutional unit always use the same FICE code, nor did the same FICE code always represent the same institutional unit). In a few cases (notably SUNY), data for a particular survey were aggregated for some of the campuses and reported individually for others. There were approximately 50 institutions for which this type of aggregation was necessary, mostly in the public sector. The number of data points by type, control, and size are shown in Table 6.1. The extent of the consolidation can be deduced by comparing that table with Table 3.2.

A list of the data elements included in our data base is shown in Table 6.2. The number of elements is quite large, even after the highly selective extraction processes which were applied to the various HEGIS surveys. The non-residential space is sub-divided into classrooms, laboratories, study, general use, special use space, etc. Enrollments are detailed by level--undergraduate, graduate, non-degree credit, and first professional students (as well as the total)--and in each category full-time, part-time, and full-time-equivalent students are retained separately. In the case of institutional employees, several kinds of staff variables were included as potential explanatory variables. These include the professional staff, the total staff, including both professional and non-professional members, the instructional staff, and the instructional staff along with all other administrative personnel (this seems intuitively to be a sensible one in terms of office space). In each category, full-time, part-time, and full-time-equivalent numbers of staff were carried.

The financial data, besides including a large number of specific expenses, includes a computed amount equivalent to the estimated instructional outlays. In effect, all revenues and expenditures from subsidized research activities were netted out, as were revenues and outlays from subsidiary enterprises, e.g., bookstores, dormitories, etc. Only the outlays directly associated with the instructional function were aggregated with the net surplus or deficit from all other activities. Inclusion of this last balancing item was believed necessary to reflect the character and total activity of the institution or campus.

The degrees granted are given by level of degree and by groups of disciplines or fields. The levels of degree include: two-year junior college degrees, bachelor's degrees, master's degrees, doctor's degrees, and first professional degrees. The discipline categories are: (1) agriculture and related sciences, (2) architecture and engineering, (3) life sciences (including health and medicine), (4) all other sciences, and (5) all other fields of study. The various fields included within each group of disciplines are shown in Table 6.3. These groupings were constructed to aggregate fields with similar requirements for laboratory space per student station (see Chapter 2). Since it was shown that the required space for laboratories differed widely from discipline to discipline, it was believed that a good way to approximate space demand without multiplying unduly the number of space variables was to perform such a grouping of the degrees granted.

Methodology

The objective of the statistical analysis was to identify a meaningful set of institutional variables which could be used to explain space availability. Various techniques of multiple regression analysis were employed to discover the relationships among the institutional space variables and the candidate explanatory variables. These regressions were performed on data for groups of institutions by type, control, and size.

First, an attempt was made to explain the various types of space (e.g., classroom or office space) individually as functions of student enrollment, total and by level, several measures of staff size, the types of degrees granted, total and by level, etc. These attempts did not produce significant correlations, and a decision was made to use only the total non-residential space as the dependent variable in all further analyses.

The simple correlation matrix was computed for each of the institutional groupings by type, size, and control. An examination of these matrices indicated that generally the following variables were most highly correlated with the non-residential space variables which appeared in the original regression equations: (1) full-time-equivalent enrollment, (2) full-time-equivalent total staff, and (3) instructional expenditures. Multiple regressions were run for each group in an attempt to explain the stock of total non-residential space with just these three variables. The results appeared most promising for the universities, and somewhat less than enlightening for other types of institutions. In these runs, each individual original institutional grouping was used separately, and in addition, some combinations of the different size groups were used. For example, in the case of public universities, the original size groupings used were: (1) less than 10,000 FTE students, (2) between 10,000 and 20,000 FTE students, and (3) greater than 20,000 FTE students. Also, all universities with greater than 10,000 FTE enrollment (groups 2 and 3) and all universities (groups 1, 2, and 3) were used. The results of these runs are shown in Table 6.4. While the multiple correlation coefficient (R^2) for all public universities exceeds .9, and was between .8 and .9 for private universities, small public colleges, and large private colleges, the results for other institutions showed a much lower R^2.[1] A detailed examination of the size of individual coefficients and their associated standard errors indicated that in some cases, especially instructional expenditures, not only was the algebraic sign wrong, indicating that richer schools have less space, but the standard error associated with the coefficient was larger than the coefficient itself. See, for example, the results for the larger private colleges or most of the two-year schools in Table 6.4. The standard errors are measures of the confidence to be placed on the individual coefficients. When the standard error is larger than the coefficient, this indicates very little confidence in the algebraic sign of the coefficient, let alone its numerical value. When one coefficient in a regression equation is in doubt, the whole equation is in doubt, so that very little confidence could be placed in many of these regression equations.

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[1] The multiple correlation coefficient, R^2, is the fraction of the original sample variance explained by the regression equation. The fraction of the variance remaining about the regression equation is $1 - R^2$.

Rather than pursue this course of attempting to find a common equation form which could be applied to all institutional groups, it appeared more reasonable to permit the regression equation form to vary from group to group in an attempt to find better regression equations to explain the stock of non-residential space. In the interests of efficiency, recourse was made to a step-wise regression process, which yields a number of different regression equations with little marginal effort. This process chooses one variable, adding it to the regression equation, producing a new regression equation at each step. The procedure is directed to insert certain chosen variables (high priority) in order, after which it will choose certain other variables, depending on their individual potential contribution to the regression. By judicious choices of variables and the priority associated with each one, this procedure can be made to yield several meaningful regression equations for each run. Typically, however not exclusively, in the following runs the staff variable was inserted first, the enrollment variable next, the instructional expenditures variable, if used, third, and the degrees granted variables last. These latter variables were entered on a common priority level so that the procedure was free to choose the most significant degree variables in order.

The results are discussed below, and were chosen from the several hundred runs designed to explain total non-residential space. Since this analysis produces meaningless as well as meaningful equations, some discretion must be used in interpreting the results. The following criteria or constraints were used to distinguish meaningful from meaningless in this study:

(1) The algebraic signs of the coefficients for the student, staff, and expenditures variables must be non-negative.

(2) The correlation between so-called independent variables must be less than .90 (thus, the linear regression equation relating the two has a correlation coefficient, R^2, of less than .81).

(3) The standard error associated with each coefficient must not exceed one-half of the absolute value of the coefficient (this can also be phrased as an "F" test, where the F associated with that coefficient must be greater than about 4 in the groupings used).

(4) As a practical consideration, no more than ten independent variables were to be included in any regression equation.

In the runs described below, the primary variables used were full-time-equivalent enrollment, full-time-equivalent staff (total professional plus non-professional), instructional expenditures, and degrees by field and level. In addition to these variables, used in several different priority schemes, the following variations were evaluated:

(1) Full-time staff was used in place of full-time-equivalent staff.

(2) Full-time enrollment was used in place of full-time-equivalent enrollment.

(3) Full-time undergraduates and full-time graduates were used in place of full-time enrollment.

(4) Instructional expenditures per full-time-equivalent enrollment was used in place of instructional expenditures.

(5) In the case of junior colleges, the full-time undergraduates and full-time non-degree credit students were used in place of full-time enrollment.

(6) Degrees by field only (i.e., all degrees regardless of level) were used in place of degrees granted by field and level.

(7) In a number of cases, a logarithmic regression was attempted with a view to fitting a production-type function, i.e., the logarithm of non-residential space was used as the dependent variable (instead of non-residential space itself), and the permissible independent variables were the logarithm of full-time-equivalent staff, the logarithm of full-time-equivalent enrollment, and the logarithm of instructional expenditures.

In some cases, these variations produced significant improvements, while in others they added nothing to the correlations obtainable with our primary set of variables.

Results

This section presents the better regression equations[1] obtained in our attempts to relate total non-residential space to our explanatory variables by type, control, and size of institution. In addition to those presented below, a large number of poor or meaningless regression equations were generated by our procedure.

Universities. As a general rule, the world of institutions granting doctorates (universities) is the best-ordered of all. Despite the fact that in most instances the multiple correlation coefficient (R^2) obtained was quite high, the form of the regression equation was not always enlightening. In this section, the results obtained for public universities are presented first, followed by the results for private universities.

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[1] In Tables 6.5 through 6.25, the variables occurring in the right-hand sides of the regression equations are full-time-equivalent enrollment (FTE-ENR), full-time enrollment (FT-ENR), full-time-equivalent total staff (FTE-STF), full-time total staff (FT-STF), instructional expenditures (EXP), and degrees by field and level. Degrees are designated by D-FF-L, where FF denotes the field (AG = agricultural sciences, AR = architecture and engineering, LF = life sciences, OS = other sciences, and OT = other), and L denotes the level of the degrees (B = bachelor's, M = master's, D = doctorates, J = two-year degrees, and P = first professional degrees). In a few instances, undergraduate enrollment (UGR), graduate enrollment (GRS), or non-degree-credit enrollment (NCR) appear, prefixed by FT- or FTE- to denote full-time and full-time-equivalent, respectively. In all cases, the standard error associated with each coefficient is given in parentheses below the coefficient. Space and expenditure variables are in thousands of square feet and thousands of dollars.

1. Public Universities with Less than 10,000 FTE Enrollment

In the case of the smaller public universities, one of the more satisfactory predictive equations was obtained. The non-residential space for these 65 institutions was explained as a function of FTE enrollment, FTE staff, and a series of advanced degrees (see Table 6.5, Equation 1). A satisfactory multiple correlation coefficient (R^2) of .81 was obtained in this case. The standard error of estimate is 210. The degrees variables included are doctorates in agriculture, doctorates in architecture and engineering, first professional degrees in the life and medical sciences, and doctor's degrees in other sciences. Note that all the coefficients are positive in this equation. The constant term is negative, indicating that this equation would produce illogical results for extremely small universities (i.e., very few students or staff for degrees granted). This means that the equation is meaningless for extremely small universities (say, less than 100 students), but it does represent a reasonable correlation for the larger institutions. This equation was judged to be the best of those obtained for the small public universities.

Perhaps some comment on what is meant by "best" is in order. From the standpoint of multiple regression analysis, an equation is better if it has a high multiple correlation coefficient, and a small standard error of estimate. In addition, the standard errors associated with each of the coefficients in the equation should be small compared to the coefficients. For purposes of explaining non-residential space in terms of the explanatory variables, one would hope for some degree of completeness with respect to the staff and student variables, i.e., if full-time undergraduates were included in an equation, then full-time graduate students should be included as well. Ideally, one would hope to have the expenditure variable included in the equation. We would prefer to have the staff and student variables in terms of FTE's, rather than full-time staff or students, since the latter tends to ignore the influence of part-time students. Thus, in this case, we tend to prefer Equation 1 in Table 6.5 to one which is similar but has full-time enrollment and full-time staff in place of FTE enrollment and FTE staff, and has a slightly higher R^2, .82, and a slightly lower standard error, 203 (see Table 6.5, Equation 2).

An equation such as Equation 1 is a fairly sensible one, since both space related to students (classroom, laboratory, etc.) and space related to staff (e.g., office space) represent major portions of total non-residential space. The numbers of advanced degrees granted by field represent an attempt to explain the differences in character among the members of this group of universities. Here we have four degree variables--doctorates or first professional degrees in the case of life sciences--representing four different fields of study. A comparison between this equation and one which includes only FTE enrollment and FTE staff shows that, by adding these four degree variables, the multiple correlation coefficient is increased from .62 to .81, and the standard error of estimate is reduced from 288 to 210 (see Table 6.5, Equations 1 and 3).

The equation referred to above (Equation 1) does not include any measure of the instructional expenditures. However, if one attempts to introduce instructional expenditures as an additional variable in the equation above, the resulting equation (see Table 6.5, Equation 4) has a slightly increased R^2 (.82) and a slightly reduced standard error (209), but the coefficient of instructional expenditures in the equation is negative. This violates our constraint No. 1. In addition, the standard error of the coefficient of expenditures is almost as large as the coefficient itself. This results in an unsatisfactory equation because it implies that schools which spend more on instruction have less space.

The question arises--what would the results be if our constraints listed above were not so stringent? We pointed out that relaxation of constraint No. 1 (that the sign of the coefficients be non-negative for staff, enrollment, and expenditures variables) does not make any particular sense within the current context. Constraint No. 3 (that the standard error of the coefficient should be less than half the magnitude of the coefficient) is sometimes relaxed to include cases where the standard error is no larger than the coefficient. In the case of the small public universities, this relaxation on constraint No. 3 permits only the addition of one more degree-type variable, with a rather insignificant increase in R^2 (less than .02).

Constraint No. 2 requires that the "independent variables" be basically independent. In this particular case, since none of the independent variables are highly correlated with one another, the exclusion of certain favored variables is not attributable to co-linearities among the independent or explanatory variables. In fact, in this case the highest correlation among the independent variables is less than .6, not a very good correlation at all.

2. Public Universities with FTE Enrollment Between 10,000 and 20,000

For the somewhat larger 54 public universities, space was best explained in terms of full-time enrollment, full-time staff, and bachelor's degrees in non-science fields (with a negative coefficient). A less impressive R^2 of .74 was obtained here (see Table 6.6, Equation 1). If FTE enrollment and FTE staff are used here, somewhat worse results are obtained (see Table 6.6, Equation 2). In this case, instead of bachelor's degrees in the non-science fields, the degree variable included was master's degrees in the non-science fields. By relaxation of constraint No. 3, R^2 can be improved by .02 (.76 instead of .74), and the resulting equations have no particularly more appealing form, but have slightly reduced standard errors of estimate. It is not felt that the minor improvement is worth the loss of confidence represented by relaxing constraint No. 3.

3. Public Universities with FTE Enrollment Greater than 20,000

The largest 26 public universities are homogeneous enough with respect to their pupil/staff ratios to provide satisfactory predictive equations of space based on either FTE enrollment or FTE staff. The R^2's for the two equations are .89 and .92, respectively, but the equations themselves are not very informative (see Table 6.7, Equations 1 and 2). In addition, the non-residential space can be correlated with the instructional expenditures alone, yielding a regression equation with an R^2 of .93. This is due to the high correlations among the FTE enrollment, FTE staff, and instructional expenditures variables. All of these correlations are greater than .94, so that only one of these may be included in an equation and still satisfy our constraint No. 2. In fact, a rather good regression equation relating staff and enrollment may be found. The equation is

$$\text{FTE-STF} = -5{,}045 + .426\ \text{FTE-ENR}$$

The R^2 for this equation is .88, a respectable correlation. For the sake of completeness, we include the other two regression equations of instructional expenditures versus FTE enrollment and versus FTE staff, having R^2's of .92 and .89, respectively:

$$\text{EXP} = -33{,}875 + 3.45\ \text{FTE-ENR} \qquad R^2 = .92$$

$$\text{EXP} = 13{,}140 + 7.47\ \text{FTE-STF} \qquad R^2 = .89$$

In the case of the degrees-granted variables, of the 20 variables applicable to the universities, the correlations of non-residential space with these variables are greater than .9 in seven of the 20 cases, the highest being for doctorates in the life and medical sciences, .981. R^2 for the equation relating non-residential space and this degree variable alone would be .96 (see Table 6.7, Equation 3).

Thus, in the case of the largest public universities, the only regression equations obtained are simple linear equations with quite high correlation coefficients. This is due primarily to the fact that the explanatory variables are highly correlated with one another, and the regression analysis breaks down when more than one of these are included in the regression equation.

4. Public Universities Having FTE Enrollment Greater than 10,000

The two largest groups of public universities were combined in an attempt to remove the co-linearities found among the variables in the larger group. While this reduced the correlations among the enrollment, staff, and expenditures variables somewhat, these correlations were still all greater than .93. Thus, again we obtained simple linear regression equations involving FTE enrollment, staff, and expenditures variables individually, all with fairly high multiple correlation coefficients (.86 to .92), but of course did not achieve the desired result (see Table 6.8, Equations 1 and 2). In addition, the correlations between non-residential space and the numbers of degrees granted by level and field was quite high in five cases.

5. All Public Universities

All public universities, regardless of size, were grouped together in a series of regression equations. Again, as before, the dominance of the largest universities is apparent. The correlations among the major "independent" variables of interest are quite high, still greater than .9. The results obtained here were simple linear regression equations (including only one independent variable) rather similar to those obtained before. These are characterized by fairly high correlation coefficients, all around .9 (e.g., see Table 6.9, Equations 1 and 2).

It would appear that the university public-based sector is a rather homogeneous group of institutions, where the mix of programs is reflected in the number of staff members. It would also appear that the mix of programs does not vary too much, since non-residential space is highly correlated with FTE students. Those institutions which are somewhat better endowed with staff are, of necessity, richer, spend more on instruction, and have slightly more space. It is fairly clear that the influence of the largest institutions is quite strong in this group of all public universities.

Apparently, when considered alone, the smaller universities are of a more heterogeneous character, leading to more intuitively attractive regression forms. The regression equations obtained in the case of the medium-sized public universities are somewhat intermediate in their intuitive appeal.

In addition to the regressions described above, an attempt was made to fit the availability of non-residential space in terms of the linear logarithmic regression. In this case, the logarithm of non-residential space was taken as the dependent variable, and the logarithms of FTE enrollment, FTE staff, and instructional expenditures were taken as the independent variables. When an equation of this sort is converted to antilogs, the equation relates non-residential space to a product of FTE enrollment, FTE staff, and instructional expenditures, each raised to some power--a type of production function. For the combined groups of all public universities, a regression equation of this type was obtained (see Table 6.9, Equation 3), having the proper algebraic signs for coefficients of all of the dependent variables and an R^2 of .87 in the logarithms. If this R^2 were put on a common basis with the other R^2's which have been quoted heretofore, it could be expected to be substantially lower.

6. Private Universities

Our sample of private universities consisted of 124 institutions with an FTE enrollment of less than 10,000, 10 with

FTE enrollment between 10,000 and 20,000, and 4 with FTE enrollment greater than 20,000. The four largest were judged to be more similar to other four-year colleges than to universities, and hence were grouped with the largest private colleges. Regressions were run for both the 124 institutions with less than 10,000 FTE enrollment, and for these 124 institutions plus the 10 with from 10,000 to to 20,000 (i.e., all private universities with FTE enrollment of less than 20,000). The largest of these ten institutions actually has an FTE enrollment of 16,299. No separate regression runs were made on these ten institutions, primarily because the ten points represent a sample too small to hope for meaningful results. In the case of the 124 private universities with FTE enrollment of less than 10,000, fairly decent regression equations were obtained (see Table 6.10, Equations 1, 2, and 3), including as independent variables (1) FTE staff, instructional expenditures, and three degree variables (with an R^2 of .89); (2) FTE enrollment, FTE staff, and eight degree variables ($R^2 = .89$); and (3) full-time undergraduate students, full-time graduate students, FTE staff, and doctor's degrees in other sciences ($R^2 = .87$). In the case of the third equation, it is interesting to note that the coefficient for full-time undergraduates was 3-1/2 times smaller than that for full-time graduate students, indicating that the marginal space requirements for graduate students are 3-1/2 times as great as for undergraduate students.

When the ten intermediate-sized private universities were included, the regression results were somewhat improved. Here, an R^2 of .92 was obtained in an equation which included FTE enrollment, FTE staff, and instructional expenditures, as well as six degree variables (see Table 6.11, Equation 1). If full-time enrollment and staff are used instead of FTE's, the results are rather similar (see Table 6.11, Equation 2). Very little is lost in R^2 by removing some of the degree variables and the expenditure variables from the equations, as illustrated by one equation obtained including FTE enrollment, FTE staff, and three degree variables as the independent variables--here the R^2 is .90 (see Table 6.11, Equation 3). (This is one of the few instances where all three of the major variables are included in a legitimate equation.)

Another series of runs was made on this same group of private universities, but excluding a number of divinity schools and very small universities (less than or equal to 500 FTE enrollment), 40 in number. Satisfactory regression equations were obtained using the data for the 94 remaining universities, with slightly reduced R^2's. For example, an R^2 of .88 was obtained using as the independent variables FTE enrollment, FTE staff, and four degree variables (see Table 6.12, Equation 1). Another equation involving FTE staff, instructional expenditures, and five degree variables was obtained, having an R^2 of .89 (see Table 6.12, Equation 2). A third equation involving full-time undergraduate students, full-time graduate students, FTE staff, and four degree variables had an R^2 of .89 (see Table 6.12, Equation 3). A fourth equation used full-time enrollment, full-time staff, instructional expenditures, and three degree variables, and had an R^2 of .88 (see Table 6.12, Equation 4).

In all of the four equations presented above, most of the correlations are due to our major staff, enrollment, and expenditures variables, along with the doctorate degrees in other sciences. The other degree variables which are included in these equations contribute only small increases in R^2. For example, removing all degree variables except doctorates in other sciences from Equation 1 results in reducing R^2 by .03 (to .85) in an equation for non-residential space, whose right-hand side is

$$76.2 + .0475 \text{ FTE-ENR} + .197 \text{ FTE-STF} + 14.3 \text{ D-OS-D}$$

Similar simplification of the other equations produces reduction of .04 in R^2 for Equations 2 and 3--both are legitimate regression equations. For Equation 4, R^2 is reduced by only .01, but the standard error of the expenditure coefficient is large enough to violate our constraint No. 3, resulting in an unsatisfactory equation.

An attempt to fit a production function in logarithms, outlined above, for private universities, produced an equation wherein the logarithm of non-residential space is explained in terms of the logarithm of staff and the logarithm of expenditures (see Table 6.12, Equation 5). The R^2 in this case was .84 for the logarithms, and would be much lower if put on a basis consistent with the other quoted multiple correlation coefficients. In order for this to be considered satisfactory at all, one must make the assumption that expenditures are proportionate to enrollments. A simple correlation between these two variables is .801, and between the logarithms is .286, neither of which is a particularly good correlation. Hence, this assumption is not warranted.

Other Four-Year Schools. While it is possible to get some fairly high correlations of a puzzling nature in the case of universities, the distribution of non-residential space on other four-year schools appears to be less well ordered. The only usable correlations for the four-year colleges were found for the smaller public colleges, and the larger private colleges. The correlations for the smaller private colleges were marginal.

1. Public Colleges with FTE Enrollment Less than 2,500

The best regression equation obtained here included as independent variables the full-time enrollment, full-time staff, and bachelor's degrees in other sciences--R^2 was .68 (see Table 6.13, Equation 1). The low multiple correlation coefficient obtained here is not indicative of a good regression equation. Deleting the degree variable here reduces R^2 by .03 (see Table 6.13, Equation 2). If

FTE enrollment and FTE staff are used in place of the full-time variables used in Equation 1, R^2 is reduced to .61 (see Table 6.13, Equation 3). By relaxing our constraint No. 3 to include those equations where the standard errors of the coefficients are no larger than the coefficients themselves, R^2 might be increased from .68 to .71 by including five additional degree variables. This still does not represent a very good regression equation.

2. Public Colleges with FTE Enrollment between 2,500 and 5,000

For the 89 colleges in this group, there was a high correlation (.926) between FTE staff and instructional expenditures. According to our constraint No. 2, then, these two variables may not appear simultaneously in a regression equation. An R^2 of .72 was obtained in an equation using full-time enrollment and full-time staff as the independent variables (see Table 6.14, Equation 1). A somewhat higher R^2 of .80 was obtained by using FTE enrollment and instructional expenditures as the independent variables (see Table 6.14, Equation 2). In this equation, it is interesting to note that the coefficient for full-time enrollment is less than that for full-time staff, and is greater than that for the smaller schools. A third equation (see Table 6.14, Equation 3) using instructional expenditures per FTE enrollment and FTE enrollment as the independent variables, along with two degree variables, had a slightly increased R^2 (.82). In some sense, this variable of expenditures per FTE enrollment has a fair appeal in terms of a measure of richness. Although this variable was tried in most of our groups, universities and two-year colleges, as well as four-year colleges, this group is one of the few in which that variable turned up as present in a legitimate equation.

3. Public Colleges with FTE Enrollment between 5,000 and 10,000

For this group of 65 four-year colleges, full-time enrollment and full-time staff account for only 47 per cent of the variance (see Table 6.15, Equation 1). The highest, that of .53, ignores graduate students as part of the enrollment, and only allocates additional space to master's degrees in other sciences (see Table 6.15, Equation 2). Adding one degree variable to Equation 1 increases R^2 to .51 (see Table 6.15, Equation 3). These results are more or less useless, unfortunately. In this case, there are no co-linearities among the proposed independent variables. A relaxation of our constraint No. 3, dealing with the standard error of the coefficients, permits no improvement in the equations.

4. Public Colleges with FTE Enrollment Greater than 10,000

This group consists of 21 four-year colleges, a somewhat small sample for this type of analysis. The equations obtained have only one variable each, either FTE staff, full-time staff, or FTE enrollment. In the case of full-time staff, only 50 per cent of the variation is explained by the equation. Even this, the best of the lot, is a pretty poor regression.

5. Public Colleges with FTE Enrollment of Less than 5,000

In an attempt to find more useful regression equations, the public colleges were considered as two groups instead of four--that is, the two smallest groups were combined and the two largest groups were combined. The group of 199 schools, a combination of the two smallest groups, produced a regression equation with an R^2 of .82, including as independent variables FTE enrollment, instructional expenditures, and degrees in agricultural sciences (see Table 6.16, Equation 1). This latter variable represents all degrees in the agricultural sciences added together. This type of variable was tried in all other groupings, as well, but did not emerge in a respectable regression equation elsewhere. The results here are better than those obtained for the smaller of the two groups, and about the same as or a little better than those obtained and discussed previously for the larger of the two small groups.

The production function approach here produces an R^2 of .62 in the logarithms of non-residential space (see Table 6.16, Equation 2). The independent variables, of course, are the log of FTE enrollment, log of FTE staff, and log of expenditures. In order for the equation to be meaningful, the R^2 in logarithms should be much higher than .62.

6. Public Colleges with FTE Enrollment Greater than 5,000

The consolidation of the two largest groups of public colleges resulted in this sample of 86 institutions. Fifty-three per cent of the variance was explained by an equation whose form is already familiar, namely, one which contained two variables--full-time enrollment and full-time staff (see Table 6.17, Equation 1). This can be improved to an R^2 of .57 by including two degree variables --master's degrees in the life and health sciences and other bachelor's degrees (see Table 6.17, Equation 2). The equation with the highest explanatory power ($R^2 = .59$) has a less comfortable form (see Table 6.17, Equation 3). It includes full-time undergraduates and full-time staff as independent variables, ignoring graduate enrollment --bringing it in only as a function of master's degrees in the life and health sciences--and has a negative coefficient for bachelor's degrees in other disciplines. In the case of these larger public colleges, a slight improvement in both the form of the equations and the R^2's was obtained by this grouping. However, the resulting equations are still not very good regressions. The relaxation of our constraint No. 3 on the size of the standard error of the coefficients does not produce anything particularly better.

The production function approach in this case essentially does not work at all, producing an R^2 of .45 and a one-variable (logarithm of staff) equation.

7. Private Colleges with Full-Time Enrollment Less than 1,000

In the private sector, where the average size of school is considerably smaller, there are 608 schools in this group with less than 1,000 enrollment. Several regression equations are obtained, all having R^2's around .60. For example, one equation, with an R^2 of .62, includes as the independent variables full-time enrollment, full-time staff, instructional expenditures, and three degree variables (see Table 6.18, Equation 1). Another, with an R^2 of .61, includes FTE enrollment, FTE staff, instructional expenditures, and two degree variables (see Table 6.18, Equation 2). A third, having an R^2 of .62, includes FTE staff, instructional expenditures, and five degree variables (see Table 6.18, Equation 3). While the form of these equations are intuitively attractive, the quality of the regressions is not good. Not much improvement may be obtained by relaxing our constraint No. 3 concerning the size of the standard errors of the coefficients.

8. Private Colleges with FTE Enrollment Between 1,000 and 2,500

In general, the equations obtained for these 278 somewhat larger private colleges are not even as good as those obtained for the smaller ones. The best one has an R^2 of .59. Two equations have this same R^2; the first includes as independent variables full-time staff, instructional expenditures, and bachelor's degrees in the other sciences (see Table 6.19, Equation 1). A second, and somewhat more complete equation, includes FTE enrollment, FTE staff, expenditures per FTE enrollment, and three degree variables (see Table 6.19, Equation 2). These regression equations are not particularly good, and no significant improvement could be realized by relaxing our constraints.

9. Private Colleges with FTE Enrollment Greater than 2,500

Attempts to run regression equations on the 49 private colleges with FTE enrollment between 2,500 and 5,000 resulted in very poor correlations, with a maximum R^2 of around .45. To this group of 49, we added the eight private colleges with FTE enrollment greater than 5,000 and the four universities with FTE enrollment greater than 20,000 which appeared to be of a similar nature. This resulted in a group of 61 institutions and vastly improved regression equations. For example, 89 per cent of the variance is explained by using just the two independent variables: FTE enrollment and FTE staff (see Table 6.20, Equation 1). The use of FTE enrollment and instructional expenditures alone produces an R^2 of .87 (see Table 6.20, Equation 2). If bachelor's degrees in agricultural sciences and master's degrees in the life sciences are included along with the FTE enrollment and FTE staff, R^2 is increased to .93 (see Table 6.20, Equation 3). The highest R^2 in this group is .95 for the equation which uses full-time enrollment, full-time staff, master's degrees in the life and medical sciences, and bachelor's degrees in the other sciences (see Table 6.20, Equation 4). An equation using FTE enrollment, FTE staff, expenditures per FTE enrollment, and two degree variables had an R^2 of .93 (see Table 6.20, Equation 5). In this group, there was a high correlation (.943) between FTE staff and instructional expenditures, accounting for the fact that these two variables do not appear together in any of our regression equations.

The production function approach here yields an R^2 of .71 in the logarithms--nowhere near as good as the straight linear regressions.

10. Private Colleges with FTE Enrollment Less than 2,500

This group is a combination of the two smaller groups of private colleges previously discussed, and consists of 886 institutions. It will be recalled that the correlations were around .60 when these two groups were run independently. By combining the two groups, somewhat improved regression equations are obtained. FTE enrollment and FTE staff explain .66 of the variance (see Table 6.21, Equation 1), and the addition of three degree variables increases R^2 to .69 (see Table 6.21, Equation 2). If, instead, we take as independent variables FTE staff and instructional expenditures, along with four degree variables, we obtain an R^2 of .74 (see Table 6.21, Equation 3). Perhaps the most satisfying equation is one which uses full-time enrollment, full-time staff, instructional expenditures, and two degree variables (see Table 6.21, Equation 4). This results in an R^2 of .75, the highest obtained in this group. This R^2 is possibly not too bad, considering the large size of the sample (886 institutions).

The relaxation of our constraint No. 3 results only in the admission of the following equation

$$25.5 + .0111 \text{ FTE-ENR} + .226 \text{ FTE-STF} + .0405 \text{ EXP}$$

with an R^2 of .72. This equation had been previously excluded because the standard error of the coefficient of FTE enrollment (.00588) was larger than half of the coefficient itself.

In an attempt to find improved correlations, 114 divinity schools were excluded from this group, resulting in a group of 772 institutions. Here an R^2 of .71 was found for an equation including the independent variables FTE enrollment, FTE staff, and instructional expenditures (see Table 6.22, Equation 1). This would not appear to be a great improvement. The production function approach here produces an R^2 of .72, not as good as the straight linear approach (see Table 6.22, Equation 2).

Two-Year Schools. At best, the regression results in the case of the two-year schools (junior colleges) were poor. The best results appeared to be for the public junior colleges with enrollments greater than 2,500, where an R^2 as high as .68 was obtained.

1. Public Junior Colleges with FTE Enrollment Less than 1,000

This group is composed of 262 small institutions. Maximum R^2's for the regression equations were less than .40, which would indicate practically no correlation at all. No possibility of improvement was possible without a complete destruction of our list of constraints.

2. Public Junior Colleges with FTE Enrollment between 1,000 and 2,500

This group is composed of 209 institutions. Here, as in the smaller group, no satisfactory results were obtained, the maximum R^2 was still less than .40, and no improvement could be found within the framework of this analysis.

3. Public Junior Colleges with FTE Enrollment between 2,500 and 5,000

For these 104 institutions, the maximum value of R^2 obtained was .42, and no significant improvement could be found by relaxing our constraints.

4. Public Junior Colleges with FTE Enrollment Greater than 5,000

For the 60 schools in this group, the maximum R^2 was .54. However, the equation had an unsatisfactory form. The .54 could, however, be increased to .59 by relaxing our constraints somewhat, but, since this is still unsatisfactory, it seems pointless to pursue.

5. Public Junior Colleges with FTE Enrollment Greater than 2,500

This grouping was a combination of the two larger groups above, and consisted of 164 institutions. The R^2's obtained for this group were somewhat improved, to a maximum of .68. This R^2 was obtained for an equation which included FTE undergraduate students, FTE non-degree credit students, full-time staff, and two degree variables, i.e., junior degrees in architecture and engineering, and in other fields (see Table 6.23, Equation 1). Using FTE staff in this equation instead of full-time staff yields an equation almost as good, having an R^2 of .65 (see Table 6.23, Equation 2). Replacing the undergraduate and non-degree-credit variables with the single variable, FTE enrollment, produces no significant change (see Table 6.23, Equation 3). Examination of the details suggests that no substantial improvement could be realized by relaxing our constraint on the standard error of the coefficients.

6. Private Junior Colleges

The world of private junior colleges consists of 164 institutions with FTE enrollment of less than 1,000, 15 institutions with FTE enrollment between 1,000 and 2,500, and 3 with FTE enrollment between 2,500 and 5,000. The first series of regression runs was made using the 164 smallest junior colleges. For these, the largest R^2 obtained was .54 in an equation using as independent variables full-time undergraduates, full-time staff, junior degrees in architecture and engineering, and other sciences (see Table 6.24, Equation 1). Here, full-time non-degree credit students were not included in the equation, detracting from the appeal of the form.

Dropping out four divinity schools from this group (resulting in a group of 160 junior colleges) increased the R^2 for the same equation to .57 (see Table 6.24, Equation 2). This is still a rather low regression coefficient. No improvement could be realized by relaxing our constraint No. 3 in either this or the previous case.

Another series of regression runs was made, using all private junior colleges--a group consisting of 182 institutions. For these, the best R^2 obtained was .57 in an equation which included full-time staff, junior degrees in architecture and engineering, and other sciences (see Table 6.25, Equation 1). Dropping out the four divinity schools (resulting in a sample of 178 institutions) increases the R^2 to .59 and permits the addition of full-time undergraduates to the equation (see Table 6.25, Equation 2). In neither case, of course, are full-time non-degree credit students used as an independent variable. At best, these regressions are poor, and no substantial improvement can be made by relaxing the constraints.

TABLE 6.1

NUMBER OF INSTITUTIONS IN COMBINED DATA BASE BY TYPE, CONTROL, AND SIZE OF INSTITUTION

Type	Control	FTE Enrollment Range	Number of Institutions
Universities	Public	Less than 10,000	65
		10,000 - 10,000	54
		Greater than 20,000	26
	Private	Less than 10,000	124
		10,000 - 20,000	10
		Greater than 20,000	4
Other Four-Year Schools	Public	Less than 2,500	110
		2,500 - 5,000	89
		5,000 - 10,000	65
		Greater than 10,000	21
	Private	Less than 1,000	608
		1,000 - 2,500	278
		2,500 - 5,000	49
		5,000 - 10,000	8
Two-Year Schools	Public	Less than 1,000	262
		1,000 - 2,500	209
		2,500 - 5,000	104
		Greater than 5,000	60
	Private	Less than 1,000	164
		1,000 - 2,500	15
		2,500 - 5,000	3

Source: HEGIS Surveys 1970-71.

TABLE 6.2

INSTITUTIONAL VARIABLES INCLUDED IN COMBINED DATA BASE

Variable	Description
1	Classroom space
2	Laboratory space*
3	Office space
4	Study space
5	Special use space
6	General use space
7	Support space
8	Medical care space
9	Total non-residential space
10	Total residential space
11	Classroom plus laboratory* space
12	Non-class laboratory space
13	Total degree-credit undergraduates - Full-time
14	" " " " Part-time
15	" " " " FTE
16	First-professional students - Full-time
17	" " " Part-time
18	" " " FTE
19	Graduate students - Full-time
20	" " Part-time
21	" " FTE
22	Non-degree-credit resident students - Full-time
23	" " " " " Part-time
24	" " " " " FTE
25	Grand total students - Full-time
26	" " " Part-time
27	" " " FTE
28	Professional staff - Full-time
29	" " FTE

* Excluding labs used for research only.

TABLE 6.2 (Cont'd)

INSTITUTIONAL VARIABLES INCLUDED IN COMBINED DATA BASE

Variable	Description
30	Professional plus non-professional staff - Full-time
31	" " " " " FTE
32	Instructional staff - Full-time
33	" " FTE
34	"Office staff" - Full-time
35	" " FTE
36	Total full-time resident faculty - Academic deans
37	" " " " " Professors
38	" " " " " Associate professors
39	" " " " " Assistant professors
40	" " " " " Instructors
41	" " " " " Lecturers
42	" " " " " Undesignated rank
43	Degrees granted - Agriculture and related sciences - FP
44	" " " " " " B
45	" " " " " " M
46	" " " " " " D
47	" " " " " " JR
48	" " Architecture and engineering - FP
49	" " " " " B
50	" " " " " M
51	" " " " " D
52	" " " " " JR
53	" " Life and health sciences - FP
54	" " " " " " B
55	" " " " " " M
56	" " " " " " D
57	" " " " " " JR

TABLE 6.2 (Cont'd)

INSTITUTIONAL VARIABLES INCLUDED IN COMBINED DATA BASE

Variable	Description
58	Degrees granted - Other sciences - FP
59	" " " " B
60	" " " " M
61	" " " " D
62	" " " " JR
63	" " Other fields - FP
64	" " " " B
65	" " " " M
66	" " " " D
67	" " " " JR
68	Total current funds revenues
69	Instructional revenue (tuition, fees, government appropriations, endowments, gifts)
70	Other revenues (total - instructional)
71	Expenditures - physical plant maintenance and operation
72	Total current funds expenditures
73	Estimate of total spent for physical plant assets
74	"Instructional expenditures"
75	Other expenditures (total - instructional)
76	Instructional profit (revenues - expenditures)
77	Other profit (revenues - expenditures)
78	Avg. mo. sal'y - Tot. FT res. fac. - Academic deans
79	" " " " " " " Professors
80	" " " " " " " Associate professors
81	" " " " " " " Assistant professors
82	" " " " " " " Instructors
83	" " " " " " " Lecturers
84	" " " " " " " Undesignated rank

Source: HEGIS Surveys 1970-71.

TABLE 6.3

GROUPINGS OF HEGIS FIELDS OF STUDY BY FIVE MAJOR FIELDS AND LEVELS OF DEGREES GRANTED

1. Agricultural Sciences

   A. Bachelor's, Master's, Doctor's Degrees

      Agriculture and Natural Resources

   B. First Professional Degrees

      None

   C. Junior Two-Year Degrees

      Natural Science Technologies

2. Architecture and Engineering

   A. Bachelor's, Master's, Doctor's Degrees

      Architecture and Environmental Design
      Engineering
      Fine and Applied Arts

   B. First Professional Degrees

      None

   C. Junior Two-Year Degrees

      Mechanical and Engineering Technologies

3. Life Sciences

   A. Bachelor's, Master's, Doctor's Degrees

      Biological Sciences
      Health Professions

   B. First Professional Degrees

      Medical Sciences

TABLE 6.3 (Cont'd)

GROUPINGS OF HEGIS FIELDS OF STUDY BY FIVE MAJOR FIELDS AND LEVELS OF DEGREES GRANTED

3. Life Sciences (Cont'd)

    C. Junior Two-Year Degrees

        Health Services and Paramedical Technologies

4. Other Sciences

    A. Bachelor's, Master's, Doctor's Degrees

        Computer and Information Sciences
        Home Economics
        Physical Sciences

    B. First Professional Degrees

        None

    C. Junior Two-Year Degrees

        Data Processing Technologies

5. Other Fields

    A. Bachelor's, Master's, Doctor's Degrees

        Area Studies
        Business and Management
        Communications
        Education
        Foreign Languages
        Law
        Letters
        Library Science
        Mathematics
        Military Sciences
        Psychology
        Public Affairs and Services
        Social Sciences
        Theology
        Interdisciplinary Studies

TABLE 6.3 (Cont'd)

GROUPINGS OF HEGIS FIELDS OF STUDY BY FIVE MAJOR FIELDS AND LEVELS OF DEGREES GRANTED

5. Other Fields Cont'd)

   B. First Professional Degrees

      Law, Theological Professions and Other - all considered as Master's Degrees, no FPD as such

   C. Junior Two-Year Degrees

      Arts and Science or General Programs
      Business and Commerce Technologies
      Public Service-Related Technologies

Source: See Appendix 6.

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TABLE 6.4

PRELIMINARY REGRESSION RESULTS: COEFFICIENTS OF FTE ENROLLMENT, FTE STAFF, AND INSTRUCTIONAL EXPENDITURES IN EQUATIONS FOR NON-RESIDENTIAL SPACE

	Number of Cases	R^2	Standard Error	Constant	FTE Enrollment Coefficient	FTE Enrollment Standard Error	FTE Staff Coefficient	FTE Staff Standard Error	Instructional Expenditures Coefficient	Instructional Expenditures Standard Error
Public Universities										
Less than 10,000	65	.62	290	57.3	.0688	.0127	.278	.0510	.00260	.00525
10,000 to 20,000	54	.65	476	229.8	.0296	.0270	.324	.0654	.00116	.00934
Greater than 20,000	26	.95	809	314.4	.00616	.0324	.185	.0579	.0239	.00906
Greater than 10,000	80	.94	595	316.7	.0117	.0156	.210	.0366	.0189	.00552
All	145	.94	488	204.4	.0270	.00867	.212	.0271	.0142	.00388
Private Universities										
Less than 10,000	124	.85	255	13.5	-.0383	.0149	.0904	.0302	.0605	.00668
All	134	.84	307	70.4	.00371	.0130	.183	.0305	.0279	.00543
Greater than 5,000	94	.79	364	124.4	-.00442	.0167	.178	.0364	.0290	.00651
Public Other Four-Year Schools										
Less than 2,500	110	.59	71	31.3	.0613	.0107	.150	.0352	.00940	.00593
2,500 to 5,000	89	.80	141	-12.1	.0529	.0221	-.0314	.0922	.0339	.00491
5,000 to 10,000	65	.35	162	67.7	.0340	.0181	.169	.104	.0114	.00846
10,000 to 20,000	21	.41	177	332.7	-.00640	.0222	.286	.161	.00478	.00856
Less than 5,000	199	.81	109	25.1	.0417	.00665	.0476	.0341	.0294	.00239
Greater than 5,000	86	.47	167	268.5	.00488	.0117	.254	.0832	.00378	.00559
Private Other Four-Year Schools										
Less than 1,000	608	.59	40	16.7	.0444	.00921	.196	.0240	.0354	.00404
1,000 to 2,500	278	.55	71	62.1	-.0213	.0135	.290	.0564	.0390	.00535
Less than 2,500	886	.72	52	25.5	.0111	.00588	.226	.0249	.0405	.00298
Greater than 2,500	61	.89	151	99.7	.0505	.00880	.105	.0347	-.00057	.00749

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TABLE 6.4 (Cont'd)

PRELIMINARY REGRESSION RESULTS: COEFFICIENTS OF FTE ENROLLMENT, FTE STAFF, AND INSTRUCTIONAL EXPENDITURES IN EQUATIONS FOR NON-RESIDENTIAL SPACE

	Number of Cases	R^2	Standard Error	Constant	FTE Enrollment		FTE Staff		Instructional Expenditures	
					Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Public Two-Year Schools										
Less than 1,000	262	.29	36	11.2	.0311	.0132	.744	.103	-.0245	.00825
1,000 to 2,500	209	.25	51	43.8	-.00352	.0106	.531	.0883	-.00424	.00628
2,500 to 5,000	104	.17	81	48.6	.0297	.0148	.270	.0958	-.00913	.00786
Greater than 5,000	60	.44	125	88.3	.0238	.00923	.270	.0800	-.00454	.00625
Greater than 2,500	164	.58	98	36.0	.0309	.00545	.265	.0553	-.00560	.00438
Private Two-Year Schools										
Less than 1,000	164	.41	29	21.6	-.00540	.0143	.429	.102	.0206	.0104
Less than 1,000*	160	.43	28	20.0	.00055	.0141	.407	.0993	.0208	.0101
All	182	.47	32	20.4	-.00930	.00890	.698	.0967	-.00246	.00900
All*	178	.48	31	19.8	-.00765	.00876	.689	.0953	-.00250	.00885

	Number of Cases	R^2	Standard Error	Constant	FTE Undergraduate		FTE Non-Credit		FTE Staff		Instructional Expenditures	
					Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Public Two-Year Schools												
Greater than 5,000	60	.51	119	86.8	.00540	.0103	.0420	.0118	.289	.0766	.00166	.00604
Less than 2,500	471	.43	43	19.7	.0228	.00632	.0207	.00843	.560	.0635	-.0135	.00464
Greater than 2,500	164	.62	95	35.7	.0156	.00648	.0494	.00704	.275	.0534	-.00046	.00428

* Without divinity schools

Source: HEGIS Surveys 1970-71.

TABLE 6.5

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PUBLIC UNIVERSITIES WITH LESS THAN 10,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.81	210	$\text{NR-SPACE} = -29.9 + \underset{(.00979)}{.0828}\ \text{FTE-ENR} + \underset{(.0374)}{.159}\ \text{FTE-STF} + \underset{(7.30)}{28.4}\ \text{D-AG-D} +$
			$+ \underset{(4.02)}{10.4}\ \text{D-AR-D} + \underset{(.440)}{2.75}\ \text{D-LF-D} + \underset{(5.05)}{12.8}\ \text{D-OS-D}$
2	.82	203	$\text{NR-SPACE} = -38.1 + \underset{(.0107)}{.0998}\ \text{FT-ENR} + \underset{(.0394)}{.159}\ \text{FT-STF} + \underset{(7.07)}{26.3}\ \text{D-AG-D} +$
			$+ \underset{(3.87)}{9.99}\ \text{D-AR-D} + \underset{(.434)}{2.84}\ \text{D-LF-D} + \underset{(4.82)}{13.0}\ \text{D-OS-D}$
3	.62	288	$\text{NR-SPACE} = 64.4 + \underset{(.0120)}{.0707}\ \text{FTE-ENR} + \underset{(.0441)}{.290}\ \text{FTE-STF}$

TABLE 6.5 (Cont'd)

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PUBLIC UNIVERSITIES WITH LESS THAN 10,000 FTE Enrollment

Equation No.	R^2	Standard Error	Regression Equation
4	.82	209	NR-SPACE = -23.8 + .0876 FTE-ENR + .175 FTE-STF + 28.4 D-AG-D + (.0105) (.0396) (7.27) + 10.3 D-AR-D + 2.93 D-LF-D + 13.8 D-OS-D - .00489 EXP (4.01) (.462) (5.09) (.00401)

Source: HEGIS Surveys 1970-71, and text.

TABLE 6.6

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PUBLIC UNIVERSITIES WITH 10,000 TO 20,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.74	411	NR-SPACE = - 161 + .132 FT-ENR + .289 FT-STF - .380 D-OT-B (.0306) (.0468) (.123)
2	.69	445	NR-SPACE = 144 + .0555 FTE-ENR + .336 FTE-STF - .501 D-OT-M (.0261) (.0420) (.188)

Source: HEGIS Surveys 1970-71, and text.

TABLE 6.7

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PUBLIC UNIVERSITIES WITH GREATER THAN 20,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.89	1,167	NR-SPACE = - 1,430 + .167 FTE-ENR (.0117)
2	.92	988	NR-SPACE = 717 + .376 FTE-STF (.0219)
3	.96	691	NR-SPACE = 1,700 + 45.3 D-LF-D (1.82)

Source: HEGIS V Surveys 1970-71, and text.

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TABLE 6.8

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PUBLIC UNIVERSITIES WITH GREATER THAN 10,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.86	891	NR-SPACE = - 604 + .152 FTE-ENR (.00684)
2	.92	675	NR-SPACE = 562 + .382 FTE-STF (.0126)

Source: HEGIS V Surveys 1970-71, and text.

TABLE 6.9

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR ALL PUBLIC UNIVERSITIES

Equation No.	R^2	Standard Error	Regression Equation
1	.86	758	NR-SPACE = -88.1 + .136 FTE-ENR (.00459)
2	.92	567	NR-SPACE = 401 + .392 FTE-STF (.00957)
3	.87	.156	LOG (NR-SPACE) = -.291 + .307 LOG (FTE-ENR) + .399 LOG (FTE-STF) + (.0474) (.0592) + .194 LOG (EXP) (.0804)

Source: HEGIS Surveys 1970-71.

TABLE 6.10

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE UNIVERSITIES WITH LESS THAN 10,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.89	225	NR-SPACE = 23.1 + .140 FTE-STF + 589 D-AG-B - 7.96 D-LF-D + (.0335) (167) (3.86) + 9.84 D-OS-D + .0347 EXP (1.65) (.00489)
2	.89	227	NR-SPACE = 65.9 + .0736 FTE-ENR + .150 FTE-STF + 457 D-AG-B + (.0149) (.0258) (178) - .837 D-AR-B = 6.79 D-AR-D - 2.06 D-LF-M + (.321) (2.37) (.990) + 2.84 D-OS-B + 5.92 D-OS-D - .341 D-OT-M + (1.06) (2.85) (.155) + 3.02 D-OT-D (.979)

TABLE 6.10 (Cont'd)

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE UNIVERSITIES WITH LESS THAN 10,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
3	.87	243	NR-SPACE = 51.1 + .0622 FT-UGR + .212 FT-GRS + .175 FTE-STF + (.0128) (.0731) (.0237) + 11.4 D-OS-D (1.84)

Source: HEGIS Surveys 1970-71.

TABLE 6.11

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE UNIVERSITIES WITH LESS THAN 20,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.92	227	$\text{NR-SPACE} = 51.0 + \underset{(.0141)}{.0385}\ \text{FTE-ENR} + \underset{(.0251)}{.113}\ \text{FTE-STF} + \underset{(176)}{552}\ \text{D-AG-B} +$ $- \underset{(.894)}{2.18}\ \text{D-LF-M} + \underset{(.841)}{2.90}\ \text{D-OS-B} + \underset{(1.72)}{8.64}\ \text{D-OS-D} +$ $- \underset{(.141)}{.298}\ \text{D-OT-M} + \underset{(.808)}{2.57}\ \text{D-OT-D} + \underset{(.00492)}{.0139}\ \text{EXP}$
2	.92	221	$\text{NR-SPACE} = 43.0 + \underset{(.0153)}{.0587}\ \text{FT-ENR} + \underset{(.0267)}{.125}\ \text{FT-STF} + \underset{(173)}{499}\ \text{D-AG-B} +$ $- \underset{(.869)}{1.97}\ \text{D-LF-M} + \underset{(.835)}{2.41}\ \text{D-OS-B} + \underset{(1.68)}{8.92}\ \text{D-OS-D} +$ $- \underset{(.125)}{.296}\ \text{D-OT-M} + \underset{(.763)}{2.57}\ \text{D-OT-D} + \underset{(.00488)}{.0112}\ \text{EXP}$

TABLE 6.11 (Cont'd)

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE UNIVERSITIES WITH LESS THAN 20,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
3	.90	249	$\text{NR-SPACE} = 59.7 + \underset{(.00780)}{.0474}\ \text{FTE-ENR} + \underset{(.0210)}{.197}\ \text{FTE-STF} + \underset{(182)}{506}\ \text{D-AG-B} +$ $+ \underset{(1.68)}{3.48}\ \text{D-AR-D} + \underset{(2.38)}{10.9}\ \text{D-OS-D}$

Source: HEGIS Surveys 1970-71, and text.

TABLE 6.12

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE UNIVERSITIES WITH GREATER THAN 500 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.88	287	$\text{NR-SPACE} = 69.0 + \underset{(.0112)}{.0318}\ \text{FTE-ENR} + \underset{(.0260)}{.153}\ \text{FTE-STF} + \underset{(211)}{476}\ \text{D-AG-B} +$ $+ \underset{(1.06)}{3.19}\ \text{D-OS-B} + \underset{(2.00)}{11.2}\ \text{D-OS-D} + \underset{(.696)}{1.84}\ \text{D-OT-D}$
2	.89	277	$\text{NR-SPACE} = 91.7 + \underset{(.0288)}{.119}\ \text{FTE-STF} + \underset{(210)}{617}\ \text{D-AG-B} - \underset{(1.08)}{2.21}\ \text{D-LF-M} +$ $+ \underset{(.980)}{3.46}\ \text{D-OS-B} + \underset{(1.89)}{8.36}\ \text{D-OS-D} + \underset{(.715)}{1.49}\ \text{D-OT-D} + \underset{(.00484)}{.0189}\ \text{EXP}$
3	.89	274	$\text{NR-SPACE} = 67.8 + \underset{(.0153)}{.0486}\ \text{FT-UGR} + \underset{(.0579)}{.257}\ \text{FT-GRS} + \underset{(.0262)}{.151}\ \text{FTE-STF} +$ $+ \underset{(208)}{660}\ \text{D-AG-B} - \underset{(1.05)}{2.14}\ \text{D-LF-M} + \underset{(1.04)}{2.48}\ \text{D-OS-B} +$ $+ \underset{(2.12)}{9.09}\ \text{D-OS-D}$

TABLE 6.12 (Cont'd)

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE UNIVERSITIES WITH GREATER THAN 500 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
4	.88	279	NR-SPACE = 43.4 + .0534 FT-ENR + .164 FT-STF + 603 D-AG-B + (.0166) (.0313) (214) - 2.30 D-LF-M + 12.3 D-OS-D +.0125 EXP (1.08) (1.83) (.00574)
5	.84	.155	LOG (NR-SPACE) = -.379 + .226 LOG (FTE-STF) + .615 LOG (EXP) (.0757) (.0875)

Source: HEGIS Surveys 1970-71.

TABLE 6.13

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PUBLIC OTHER FOUR-YEAR SCHOOLS WITH LESS THAN 2,500 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.68	63	$\text{NR-SPACE} = 32.1 + \underset{(.0110)}{.0652}\ \text{FT-ENR} + \underset{(.0173)}{.205}\ \text{FT-STF} + \underset{(.907)}{2.50}\ \text{D-OS-B}$
2	.65	65	$\text{NR-SPACE} = 29.4 + \underset{(.0102)}{.0785}\ \text{FT-ENR} + \underset{(.0178)}{.206}\ \text{FT-STF}$
3	.61	69	$\text{NR-SPACE} = 48.6 + \underset{(.0115)}{.0475}\ \text{FTE-ENR} + \underset{(.0186)}{.196}\ \text{FTE-STF} + \underset{(.991)}{2.95}\ \text{D-OS-B}$

Source: HEGIS Surveys 1970-71.

TABLE 6.14

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PUBLIC OTHER FOUR-YEAR SCHOOLS WITH 2,500 TO 5,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.72	168	$\text{NR-SPACE} = -46.3 + \underset{(.0247)}{.0520}\ \text{FT-ENR} + \underset{(.0441)}{.540}\ \text{FT-STF}$
2	.80	140	$\text{NR-SPACE} = -9.5 + \underset{(.0209)}{.0506}\ \text{FTE-ENR} + \underset{(.00191)}{.0324}\ \text{EXP}$
3	.82	135	$\text{NR-SPACE} = -180.0 + \underset{(.0203)}{.0818}\ \text{FTE-ENR} + \underset{(.955)}{2.22}\ \text{D-AG-B} + \underset{(3.58)}{8.38}\ \text{D-LF-M} +$ $+ \underset{(.00766)}{.136}\ \text{EXP/FTE-ENR}$

Source: HEGIS Surveys 1970-71.

TABLE 6.15

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PUBLIC OTHER FOUR-YEAR SCHOOLS WITH 5,000 TO 10,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.47	144	NR-SPACE = -59.9 + .0612 FT-ENR + .310 FT-STF (.0158) (.104)
2	.53	138	NR-SPACE = -65.9 + .0650 FT-UGR + .277 FT-STF + 7.24 D-OS-M (.0155) (.0979) (3.26)
3	.51	140	NR-SPACE = -45.7 + .0589 FT-ENR + .278 FT-STF + 7.16 D-OS-M (.0154) (.102) (3.32)

Source: HEGIS Surveys 1970-71.

TABLE 6.16

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PUBLIC OTHER FOUR-YEAR SCHOOLS WITH LESS THAN 5,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.82	107	$\text{NR-SPACE} = 30.4 + \underset{(.00660)}{.0382}\ \text{FTE-ENR} + \underset{(.647)}{2.16}\ \text{D-AG-A} + \underset{(.00137)}{.0325}\ \text{EXP}$
2	.62	.190	$\text{LOG (NR-SPACE)} = -.396 + \underset{(.0594)}{.320}\ \text{LOG (FTE-ENR)} + \underset{(.0726)}{.265}\ \text{LOG (FTE-STF)} + \underset{(.0771)}{.291}\ \text{LOG (EXP)}$

Source: HEGIS Surveys 1970-71, and text.

TABLE 6.17

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PUBLIC OTHER FOUR-YEAR SCHOOLS WITH GREATER THAN 5,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.53	156	NR-SPACE = 194.4 + .0227 FT-ENR + .273 FT-STF (.0112) (.0842)
2	.57	151	NR-SPACE = 204.8 + .0383 FT-ENR + .264 FT-STF + 4.35 D-LF-M + (.0136) (.0842) (2.03) - .126 D-OT-B (.0570)
3	.59	148	NR-SPACE = 182.4 + .0444 FT-UGR + .269 FT-STF + 4.16 D-LF-M + (.0134) (.0787) (2.00) - .133 D-OT-B (.0547)

Source: HEGIS Surveys 1970-71.

TABLE 6.18

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE OTHER FOUR-YEAR SCHOOLS WITH LESS THAN 1,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.62	39	$\text{NR-SPACE} = 18.7 + \underset{(.00960)}{.0472}\ \text{FT-ENR} + \underset{(.0256)}{.228}\ \text{FT-STF} + \underset{(3.61)}{7.69}\ \text{D-AG-B} +$ $- \underset{(.223)}{.613}\ \text{D-AR-M} + \underset{(.341)}{1.007}\ \text{D-OS-B} + \underset{(.00406)}{.0302}\ \text{EXP}$
2	.61	40	$\text{NR-SPACE} = 18.9 + \underset{(.00936)}{.0346}\ \text{FTE-ENR} + \underset{(.0237)}{.194}\ \text{FTE-STF} - \underset{(.225)}{.809}\ \text{D-AR-M} +$ $+ \underset{(.348)}{1.13}\ \text{D-OS-B} + \underset{(.00404)}{.0356}\ \text{EXP}$
3	.62	39	$\text{NR-SPACE} = 22.8 + \underset{(.0234)}{.200}\ \text{FTE-STF} + \underset{(3.64)}{8.23}\ \text{D-AG-B} - \underset{(.228)}{.613}\ \text{D-AR-M} +$ $+ \underset{(.346)}{1.01}\ \text{D-OS-B} + \underset{(.0310)}{.140}\ \text{D-OT-B} - \underset{(.0822)}{.197}\ \text{D-OT-M} +$ $+ \underset{(.00344)}{.0385}\ \text{EXP}$

Source: HEGIS Surveys 1970-71.

TABLE 6.19

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE OTHER FOUR-YEAR SCHOOLS WITH 1,000 TO 2,500 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.59	68	$\text{NR-SPACE} = 36.1 + \underset{(.0560)}{.345}\ \text{FT-STF} + \underset{(.430)}{1.55}\ \text{D-OS-B} + \underset{(.00495)}{.0289}\ \text{EXP}$
2	.59	68	$\text{NR-SPACE} = -42.9 + \underset{(.0142)}{.0386}\ \text{FTE-ENR} + \underset{(.0538)}{.289}\ \text{FTE-STF} - \underset{(.752)}{1.73}\ \text{D-AR-M} +$ $+ \underset{(.223)}{.490}\ \text{D-LF-B} + \underset{(.441)}{1.74}\ \text{D-OS-B} + \underset{(.00775)}{.0513}\ \text{EXP/FTE-ENR}$

Source: HEGIS Surveys 1970-71.

TABLE 6.20

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE OTHER FOUR-YEAR SCHOOLS WITH GREATER THAN 2,500 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.89	150	$\text{NR-SPACE} = 98.8 + \underset{(.00601)}{.0500}\ \text{FTE-ENR} + \underset{(.0169)}{.102}\ \text{FTE-STF}$
2	.87	161	$\text{NR-SPACE} = 57.1 + \underset{(.00874)}{.0408}\ \text{FTE-ENR} + \underset{(.00393)}{.0191}\ \text{EXP}$
3	.93	119	$\text{NR-SPACE} = 157 + \underset{(.00617)}{.0267}\ \text{FTE-ENR} + \underset{(.0136)}{.116}\ \text{FTE-STF} + \underset{(2.40)}{12.8}\ \text{D-AG-B} +$ $+ \underset{(.650)}{2.790}\ \text{D-LF-M}$
4	.95	105	$\text{NR-SPACE} = 121 + \underset{(.00874)}{.0285}\ \text{FT-ENR} + \underset{(.0111)}{.124}\ \text{FT-STF} + \underset{(.682)}{2.80}\ \text{D-LF-M} +$ $+ \underset{(.438)}{2.35}\ \text{D-OS-B}$

TABLE 6.20 (Cont'd)

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE OTHER FOUR-YEAR SCHOOLS WITH GREATER THAN 2,500 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
5	.93	120	NR-SPACE = -99.7 + .0564 FTE-ENR (.00691) + .123 FTE-STF (.0180) + 6.85 D-AG-B (2.66) + - 1.28 D-AR-M (.476) + .0920 EXP/FTE-ENR (.0270)

Source: HEGIS Surveys 1970-71.

TABLE 6.21

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE OTHER FOUR-YEAR SCHOOLS WITH LESS THAN 2,500 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.66	57	NR-SPACE = 24.2 + .0605 FTE-ENR + .418 FTE-STF (.00508) (.0226)
2	.69	55	NR-SPACE = 27.8 + .0220 FTE-ENR + .391 FTE-STF + .546 D-LF-B + (.00749) (.0218) (.130) + 1.82 D-OS-B + .116 D-OT-B (.283) (.0337)
3	.74	50	NR-SPACE = 26.6 + .218 FTE-STF - .854 D-AR-M + .382 D-LF-B + (.0239) (.258) (.120) + 1.33 D-OS-B + .0563 D-OT-B + .0348 EXP (.265) (.0245) (.00267)
4	.75	50	NR-SPACE = 26.7 + .0142 FT-ENR + .271 FT-STF - .894 D-AR-M + (.00649) (.0259) (.251) + 1.47 D-OS-B + .0325 EXP (.259) (.00297)

Source: HEGIS Surveys 1970-71.

TABLE 6.22

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE OTHER FOUR-YEAR SCHOOLS WITH LESS THAN 2,500 FTE ENROLLMENT*

Equation No.	R^2	Standard Error	Regression Equation
1	.71	54	NR-SPACE = 22.0 + .0155 FTE-ENR + .227 FTE-STF + .0398 EXP (.00636) (.0259) (.00312)
2	.72	.187	LOG (NR-SPACE) = -.387 + .242 LOG (FTE-ENR) + .466 LOG (FTE-STF) + (.0452) (.0473) + .243 LOG (EXP) (.0500)

* Without divinity schools

Source: HEGIS Surveys 1970-71.

TABLE 6.23

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PUBLIC TWO-YEAR SCHOOLS WITH GREATER THAN 2,500 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.68	87	NR-SPACE = 22.7 + .0236 FTE-UGR + .0534 FTE-NCR + .351 FT-STF + (.00604) (.00690) (.0537) + .132 D-AR-J - .0796 D-OT-J (.0649) (.0236)
2	.65	91	NR-SPACE = 25.2 + .0276 FTE-UGR + .0538 FTE-NCR + .242 FTE-STF + (.00630) (.00727) (.0469) + .147 D-AR-J - .0682 D-OT-J (.0676) (.0246)
3	.64	92	NR-SPACE = 22.1 + .0377 FTE-ENR + .201 FTE-STF + .221 D-AR-J + (.00523) (.0457) (.0654) - .0846 D-OT-J (.0245)

Source: HEGIS Surveys 1970-71, and text.

TABLE 6.24

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR PRIVATE TWO-YEAR SCHOOLS WITH LESS THAN 1,000 FTE ENROLLMENT

Equation No.	R^2	Standard Error	Regression Equation
1	.54	25	NR-SPACE = 19.4 + .0329 FT-UGR + .519 FT-STF + 1.31 D-AR-J + (.0134) (.0741) (.262) - 1.0679 D-OS-J (.324)
2*	.57	24	NR-SPACE = 17.6 + .0407 FT-UGR + .492 FT-STF + 1.32 D-AR-J + (.0129) (.0707) (.249) - 1.04 D-OS-J (.308)

* Without divinity schools

Source: HEGIS Surveys 1970-71.

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TABLE 6.25

REGRESSION RESULTS: EQUATIONS FOR NON-RESIDENTIAL SPACE FOR ALL PRIVATE TWO-YEAR SCHOOLS

Equation No.	R^2	Standard Error	Regression Equation
1	.57	29	NR-SPACE = 21.5 + .675 FT-STF + .155 D-AR-J - .322 D-OS-J (.0515) (.0421) (.0797)
2 *	.59	28	NR-SPACE = 19.6 + .0193 FT-UGR + .569 FT-STF + .154 D-AR-J + (.00921) (.0721) (.0406) - .367 D-OS-J (.0802)

* Without divinity schools

Source: HEGIS Surveys 1970-71.